SIMPLIFIED IEE AMENDMENT

ACTIVITY DATA

Activity Name:	North Sinai Initiative Assistance Agreement (263-0297)
Geographic Location(s) (Country/Region)**:**	Egypt, Middle East
Amendment (Yes/No), if Yes indicate # (1, 2...):	Yes, Amendment Number 7
Implementation Start/End Dates (FY or M/D/Y):	FY 2010 - FY 2022
If Amended, specify New End Date:	N/A
Solicitation/Contract/Award Number(s):	AID-263-C-15-00003
Implementing Partner(s):	The Holding Company for Water and Wastewater
Bureau Tracking ID:	ME 20-77
Tracking ID of Related RCE/IEE:	ME 19-61,ME 17-46, ME 16-38, ME 15-32, ME 13-68, ME10-99 and ME 20-61
Tracking ID of Other, Related Analyses:	

ORGANIZATIONAL/ADMINISTRATIVE DATA

Implementing Operating Unit(s): (e.g. Mission or Bureau or Office)	Office of Economic Growth
Other Affected Operating Unit(s):	USAID EGYPT
Lead BEO Bureau:	ME
Original Funding Amount:	$55.6 Million
If Amended, specify funding amount:	N/A
If Amended, specify new funding total:	N/A
Prepared by:	Atef Abdel Sayed
Date Prepared:	09/09/2020

ENVIRONMENTAL COMPLIANCE REVIEW DATA

Analysis Type:	☒Initial Environmental Examination Amendment ☐Request for Categorical Exclusion Amendment
Environmental Determination(s):	☐Categorical Exclusion(s) ☒Negative with Conditions ☐Positive ☐Deferred (per 22 CFR 216.3(a)(7)(iv))
IEE Expiration Date (if applicable)**:**	September 2022
Additional Analyses/Reporting Required:	
Climate Risks Identified (#):	Low ___#___ Moderate ___#___ High ___#___
Climate Risks Addressed (#):	Low ___#___ Moderate ___#___ High ___#___

1.0 PURPOSE OF THE AMENDMENT

The purpose of this amendment is to:

1. Update the compliance record North Sinai Initiative Assistance Agreement (263-0297) to include the approved Environmental Scoping Statement for construction and operation of the El-Roda Desalination Plant and Associated Fish Farm
2. Revise the IEE for the El-Roda Desalination Plant and Associated Fish Farm from Positive Determination to Negative Determination with Conditions

2.0 OVERVIEW OF WORK

The El-Roda village desalination plant is located in the North Sinai Governorate and will serve the village and seven adjacent communities. The total project area is approximately 45,700 m^2, and located to the west of El-Roda village. The new desalination plant will use Reverse Osmosis (RO) technology for the treatment of up to 500 m3 of saline groundwater per day. As part of the plant's construction, the project will establish a series of fishponds to utilize the brine water waste produced by the plant. The establishment of the fishponds will increase income generating opportunities for the fishing communities along the North Sinai coast by encouraging off-season micro-enterprises associated with ponds.

In August 2020, USAID/Egypt commissioned a scoping study to ascertain the potential impacts and identify mitigation measures. The Scoping Study examined both projects and their impact on the environment and the local community. Specifically, the study examined the project location, project facilities, each of the project components and processes and the proposed aquaculture operation. The study states that the implementation of all proposed mitigation measures and their inclusion in the construction and operation contractors' contracts is expected to result in the implementation of the project without any significant negative impact on any of the environmental aspects in the area. Moreover, the construction of the plan and fish farm is expected to have positive social impacts on the surrounding community in El-Roda village in particular and on North Sinai Governorate in general.

This activity is expected to require two years to complete, including plant construction, establishment of a community-based association, and aquaculture training. When engineering design is complete, and the associated detailed implementation time schedule is initiated, the Mission will act accordingly to amend the completion date of the Assistance agreement if needed.

3.0 RECOMMENDATIONS

Pursuant to the findings of the Scoping Study which found that the El-Roda Desalination Plant and Associated Fish Farm activity is not expected to have significant negative social or environmental impacts, the appropriate IEE determination for this activity is "Negative Determination with Conditions". To ensure environmental compliance the activity will strictly follow the the mitigation, management, and monitoring measures specified below:

1. Mitigation Measures - Table 9-1 Environmental Impact assessment and proposed mitigation measures (during construction and Operation Phases) - Pages 81 to 84.

2. Environmental Management Plan (during construction and Operation Phases) - Pages 85 to 91.
3. Environmental Monitoring Plan (during Construction and Operation Phases) - Pages 92 to 95.

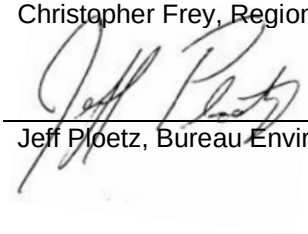
4.0 ATTACHMENTS

1. Environmental Scoping Statement: El-Roda Desalination Plant and Associated Fish Farm Water August 2020
2. Climate-Change Resilience: climate change-related sectoral risks, GOE mitigation-adaptation strategies, and USAID/Egypt related activities
3. Climate Exposure Information

USAID APPROVAL OF IEE AMENDMENT

PROJECT/ACTIVITY NAME: North Sinai Initiative Assistance Agreement (263-0297).

Bureau Tracking ID:

Approval:	M Sancho Margaret Sancho, Deputy Mission Director	09/22/2020 Date
Clearance:	MT Michael Trueblood, Office of Economic Growth Acting Director	09/20/2020 Date
Clearance:	SIB - Cleared by Email Stuart Banashek, Mission Environmental Officer	9/20/2020 Date
Clearance:	CJF - Cleared by email Christopher Frey, Regional Environmental Advisor	23-Sep-20 Date
Concurrence:	 Jeff Ploetz, Bureau Environmental Officer [*required*]	9/24/2020 Date

DISTRIBUTION:

- Assistance Agreement Core File
- Environmental Compliance Database

USAID
FROM THE AMERICAN PEOPLE

WATER AND WASTEWATER CONSTRUCTION PROGRAM
CONSTRUCTION MONITORING AND ENGINEERING SUPPORT SERVICES (CMESS)

Environmental Scoping Statement

El-Roda Desalination Plant and Associated Fish Farm

August 2020

CMESS 6-32 M (E)

This publication was produced for review by the United States Agency for International Development (USAID). It was prepared by Chemonics Egypt

Chemonics Egypt Consultants
Ahmad Gaber & Associates
6 Dokki Street, Dokki, Giza, Egypt
Phone: +20-2 33.36.41.59
+20-2 33.36.09.18
Fax: +20-2 37.49.24.72
Email: chemegy@chemonicsegypt.com

Project Name:	Construction Monitoring and Engineering Support Services (CMESS)
Contract Name:	Construction Monitoring, Project Oversight, and Engineering Support to USAID/Egypt
Contract Number:	AID-263-C-15-00003
Document Title:	Environmental Scoping Statement of El-Roda Desalination Plant and Associated Fish Farm
Document Type:	Technical Deliverable
Date:	August, 2020
Document Number:	CMESS 6-32 M (E)
Submitted to:	USAID, Egypt
Prepared by:	Chemonics Egypt Consultants

Table of Contents

List of Figures

List Of Tables

1. Introduction

1.1 Background

Egypt is facing water resources challenging that affect its socio-economic development strategy. The desert areas located away from the Nile River is lacking freshwater from the Nile River or from the limited fresh groundwater storage (if any). Areas located along the coastal line of the Mediterranean Sea are characterized by its limited rainfall and the possible occurrence of saline or brackish groundwater supply. El-Roda Village is one of the fragile communities that are suffering from the freshwater availability. Therefore, the Government of Egypt along with USAID are seeking all possible solutions to provide this village with the freshwater supply that would serve the needs of the residence at present and in the near future.

In view of the attention directed by USAID to satisfy the pressing potable water needs of Sinai Peninsula people, this project presents one of the major initiatives adopted to withstand the critical potable water supply shortage in North Sinai Governorate.

The United States Agency for International Development (USAID) and the Ministry for Investment and International Cooperation (MIIC) signed Amendment No. 1 to North Sinai Initiative (NSI) Assistance Agreement. As per the Government of Egypt (GOE) request, this amendment will allow USAID to support and fund the construction of a new water desalination plant at El-Roda village, Beir Al Abd District in North Sinai Governorate the project aims at bridging the gap of water supply. Additionally, as per the GOE's proposal, other wells water in addition to the brine water produced from the desalination process may be used to initiate a fish farm at the location near the village.

A 500 m3 desalination plant was conceptually designed to have a life of 15 years for its electro-mechanical and plumbing components. The conceptual design was based on the water salinity concentrations reached within the hydro-geological study and confirmed by a previous study done by the ministry of irrigation and water resources. The proposed desalination plant shall safely answer this need with a direct investment cost of the desalination plant is 36.2 million EGP. Consequently, the direct investment unit cost of one cubic meter of fresh water is 13.22 EGP/m3 and a total unit cost of 24.13 EGP/m3 after including the running, operating and maintenance costs.

The aquaculture project will provide a number of direct job opportunities for the youth of the village of El-Roda and the neighboring villages, especially after the fish farms project in the Ghareef El Ghazlan area was suspended. Additionally, the aquaculture project is expected to produce about 33 tons/year of grade 2 and 3 fish that will take part

in making-up for the reduction of production in North Sinai in the past years. The aquaculture project is also expected to produce about 17 tons/year of grade 1 fish that will be a candidate for export.

This action is expected to create new direct job opportunities for more than 20 of the local inhabitants in addition to new jobs within the desalination plant and new job opportunities in the salt industry, in addition to many indirect job opportunities.

According to the TOR that CHEMONICS EGYPT received, a socio-environmental study was required to assess the impact of the desalination plant at El-Roda, North Sinai and an associated fish farm. Consequently, CHEMONICS EGYPT asked GREEN PLUS to prepare the scoping statement report and the ESIA study. A consortium team of CHEMONICS EGYPT and GREEN PLUS has visited the site, conducted the required consultation, assessed the baseline, and prepared this Scoping Statement Report, and is collaborating to prepare the required ESIA.

From a managerial perspective, the desalination plant will be totally managed by the North and south Sinai Company for water and wastewater. Meanwhile, the fish farm will be owned by the government and jointly managed by the government and communal entities formed by the local population while the revenues will be directed towards the welfare of the local population. On the other hand, the salt production ponds will be leased to an investor through bidding procedures while the leasing revenues will be directed towards the welfare of the local population.

1.2 Water supply in the project area: -

Sources of Water Supply in North of Sinai

El-Roda Village is served with Nile water supply through the pipeline passing near the village. This freshwater is used only to fulfill the domestic water demand. The scarce seasonal rainfall within the project area is another source of freshwater that is efficiently utilized for the seasonal agriculture development. The climate data indicates that the annual rainfall in the study area varies between 35 and 50 mm/year. Despite its limited quantity, it is considered as the main source of recharge to the shallow aquifers (sand dunes and wadi deposits). Nevertheless, the limited recharge rate to the shallow aquifer is not sufficient for any sustainable development in the area. In addition to these two freshwater resources, a limited storage of brackish groundwater exists in the shallow aquifer and the local sand dune aquifer.

The hydrogeological study indicated that the salinity of the brackish and saline groundwater into the Quaternary aquifer might reach 27,000 ppm and will increase with time to reach up to 35,000 ppm (sea water). This is due to the fact of the hydraulic interaction between the coastal aquifer and the Mediterranean Sea which is considered the main recharge source. Meanwhile, the discharge rate from the well varies between 25 to 40 m3/hr for continuous daily withdrawal (24 hours).

Presently received potable water at El Arish City is around 50,000 – 60,000 m3/day, much less than the 80,000m3/day which used to reach the city some years ago indicating the short of potable water reaching El Arish City with a trend expected to continue and the quantity might decrease in the future.

This has been attributed to "losses" along the potable water transmission pipelines from Qantara Sharq Water Station as a result of the use of potable water from these pipelines to irrigate the orchards of farmers.

There are various sources of water supply in Sinai as the following;

1.2.1 Desalinated water

There are two kinds of groundwater quality in Sinai: brackish and low salinity. The brackish water supply has a salinity of up to 20,000 ppm. The water delivered from the wells goes directly to agriculture if it is of low salinity. The rest has to be desalinated by reverse osmosis (RO) or electrodialysis (ED).

1.2.2 Piped water Supplies

Potable water transported by pipeline was inaugurated 12 years ago to El-Arish. The pipeline is 158 km in length and 700 mm diameter. The same pipeline continues to Sheikh Zuwayed and Rafah. In 2000, a new 3-year project was announced to supply water to Gifgafa in North of Sinai by a pipeline with a length of 182 km and a total capacity of 60,000 m^3/day. In addition, there is El Qantara - EL Arish 1000 mm diameter water pipeline supplies El-Roda Village with 1000 m3 of fresh Nile water per day.

1.2.3 Groundwater Use in North of Sinai

Unsurprisingly, groundwater use from either deep or shallow dug wells, springs ('ain) or seepages is highly variable. However, areas just to the west of the Gaza/Israeli border or downslope from the El Tih plateau or El Maghara Mountains seem to benefit somewhat from water percolating through sloping aquifers and emerging near the surface in various places. Water quality varies considerably from near potable in some wells near brackish elsewhere.

In general, groundwater supplies appear to be steadily dwindling in most places. Deep wells, which are drilled and installed by the Ministry of Water Resources and Irrigation (MWRI) number 70 in central Sinai but as of 2002, only 36 were in operation. The remainder had been either abandoned, had not been equipped for water withdrawals or were subject to tribal conflicts.

The main hydrogeological characteristics of the study area along with the design recommendation for the feeding wells and the different options to manage the reject of the desalination plant.

This range of salinity is in agreement with what was reported by the ministry of irrigation and water resources.

2. Description El-Roda Desalination Project and associated Fish Farm

2.1 The Project Location

In September 2019, the United States Agency for International Development (USAID) and the Ministry for Investment and International Cooperation (MIIC) signed Amendment No. 2 to North Sinai Initiative (NSI) Assistance Agreement. As per the Government of Egypt (GOE) request, this amendment will allow USAID to support and fund the construction of a new water desalination plant at El-Roda village, Bir Al Abd District in North Sinai Governorate. Additionally, as per the GOE's proposal, wells water in addition to the brine water produced from the desalination process may be used to initiate a fish farm at the location near the village.

El-Roda village that located on the west side of Al-Arish, which is administratively affiliated to the North Sinai Governorate. El-Roda village is located 6 km to the south of the Mediterranean Sea and at the middle distance between Ber El Abd and Al Arish City, and very close to EL-Kantara shark/Al-Arish Rd from North and South. The total project area of the proposed project is 45,767 m^2 which located to the Western direction of the existing residential area of El-Roda village.

The project is close to the main road, EL-Kantarra shark/Al-Arish, in an unused publicly area, and sufficient enough for the project. Additionally, it is also believed to be more suitable for the project as it is beside existing salt ponds in which part of the brine water could be discharged to be used for industrial salt production, in addition to being on a leveled grade which means that the earthwork will be minimal.

2.2 Landscape and Visual

Due to the security conditions at the project area, the consultant was unable to visit all the areas surrounding the project, and it was not allowed to take some pictures of the buildings surrounding the site.

In general, the landscape of project area can mainly be described as flat levelled desert plains without any specific features. There are no steep slopes or escarpments that might be adverse for area development. The area shows mainly desert with wet and Marsh. The area of the project seems to be used as solid waste dumping area since there are historical accumulation of some piles of old solid waste scattered inside the project site. In addition,

there are quantities of waste water resulting from excavation work during the implementation of drainage network projects have been discharged at the project site. It seems like salty water. The project area lacks any plants of special value, whether environmental or economic. As there are only some desert wild plants scattered at the site with only one Palm tree at the Eastern North of the project area.

The consultant defined a residential area of El-Roda village at the East direction of the project which include a preparatory school at the boarder of North direction, a Primary school at the Western East direction, and a Health care center at the boarder of the west direction of the village. There is a water elevation plant prepared with the tanks and the network ready to be connected by the desalination plant, since it is close to the project site from the east direction.

The coordinates of the Project area are presented in the Table 2-1

Table 2-1 The coordinates of the Project area

Point	Coordinates	
	N	E
A	31° 2'26.25"	33°20'25.03"
B	31° 2'18.42"	33°20'26.00"
C	31° 2'17.82"	33°20'20.39"
E	31° 2'22.40"	33°20'19.05"
F	31° 2'22.15"	33°20'17.17"
G	31° 2'25.40"	33°20'16.57"

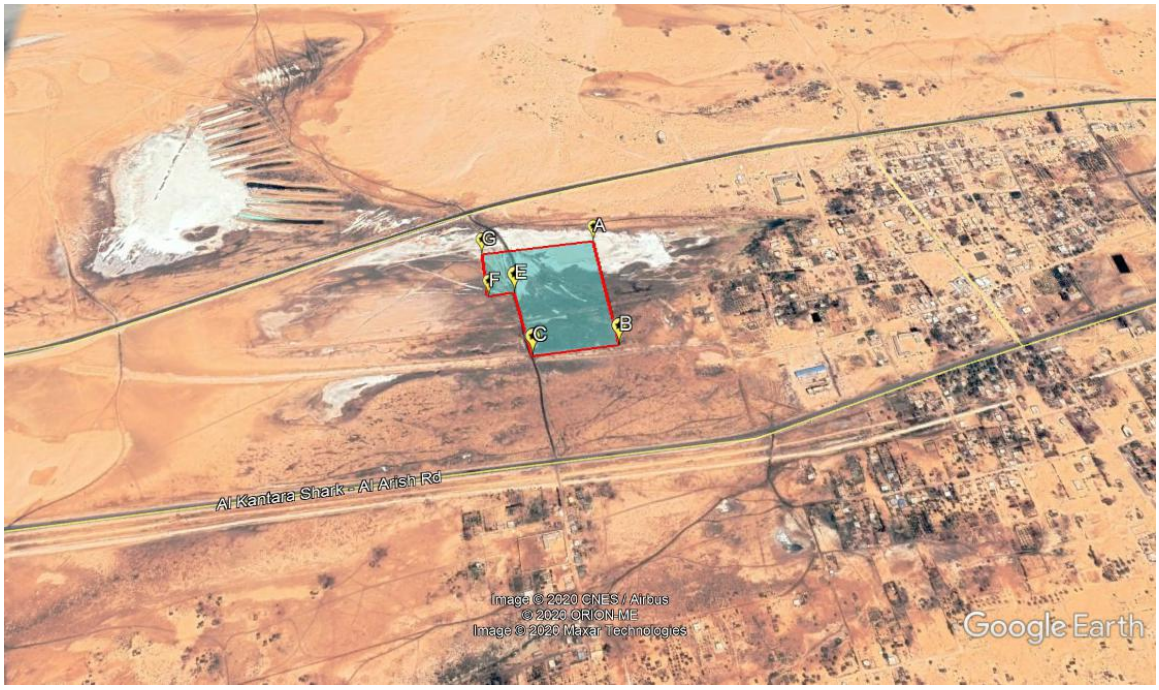


Figure 2-1 Project area Coordinates

Figure 2-2 illustrate the visual assessment and land use at the site and the surrounding.

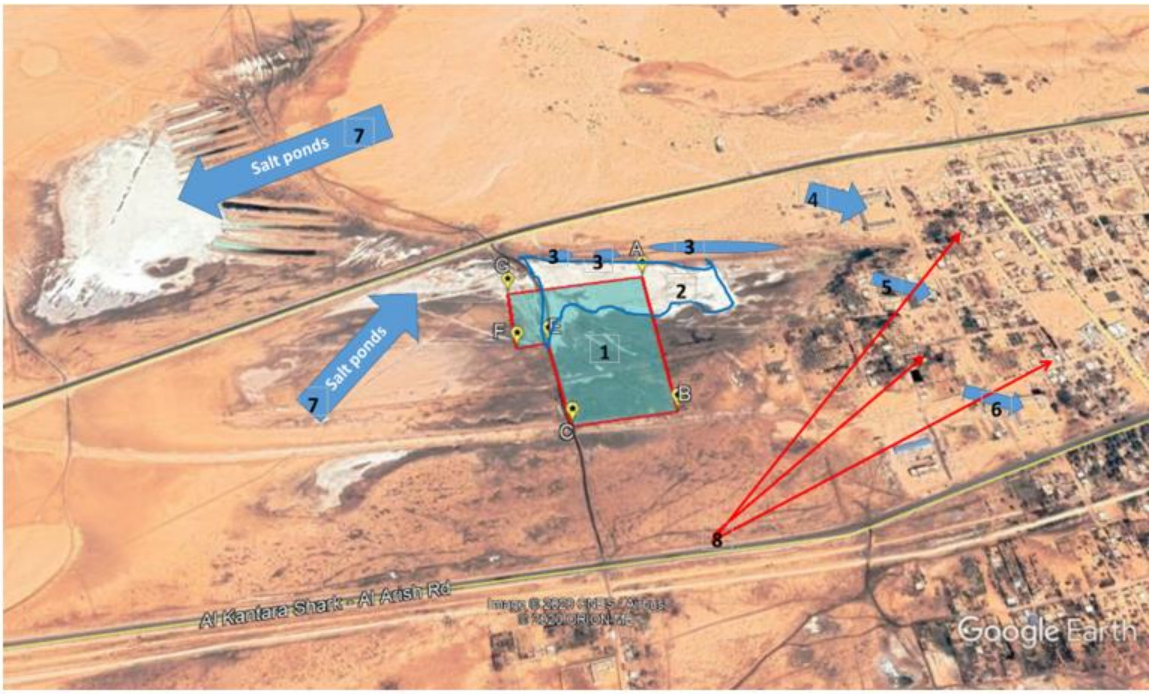
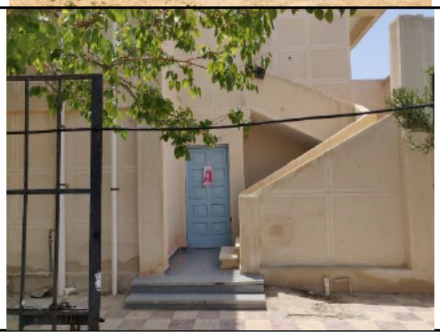


Figure 2-2 Land Use in EL-RODA

Table 2-2 describe all the above visual and land scape in relation to the project site.

Table 2-2 Description of the visual and land scape in relation to the project site.

Item	Coordinates	Description and importance as visual receptor	Photo
1	Reference to **Table 2-1**	**Project boarders**	
2	31 02 25.44 N 33 20 24.31 E	**A layer of salty water disposed at the site forming like a Marsh**	
3	31 02 27.64 N 33 20 24.44 E	**Historical accumulation of solid waste piles**	
4	31 02 31.15 N 33 20 40.44 E	**El-Roda preparatory school**	
5	31 02 24.7 N 33 20 43.4 E	**El-Roda Health Center**	
6	31 02 18.04 N 33 20 46.7 E	**El-Roda Primary school**	no photo

Item	Coordinates	Description and importance as visual receptor	Photo
7	31 02 31.18 N 33 19 57.31 E	**Salts Ponds projects existing close to the project site**	

2.3 Project components and process

The hydrogeologic study indicated that the salinity of the brackish and saline groundwater into the Quaternary aquifer might reach 27000 ppm and will increase with time to reach up to 35000 ppm (sea water). This is due to the fact of the hydraulic interaction between the coastal aquifer and the Mediterranean Sea which is considered the main recharge source. The discharge rate from the well varies between 25 to 40 m^3/h for continuous daily withdrawal (24 hours). Hence: The project for El-Roda development will be implemented through 2 stages:

1st stage includes:

1- Drilling, testing and construction of 2 test wells at depth - 60 m for each one, which would be transformed into productive wells at the positive results. The pumping test will be carrying out (withdrawal & recovery) for 3 days minimum and 7 days' maximum.
2- Carrying out quick mathematical model for future different working scenarios (30 years) to follow-up the extraction, drawdown and quality of the water in order to define the suitable distance between production wells in the same well field.

2nd Stage includes:

1- Depending on the above steps the decision of drilling 10 wells at depth – 60 m. for each one (well field) at suitable distance between wells.

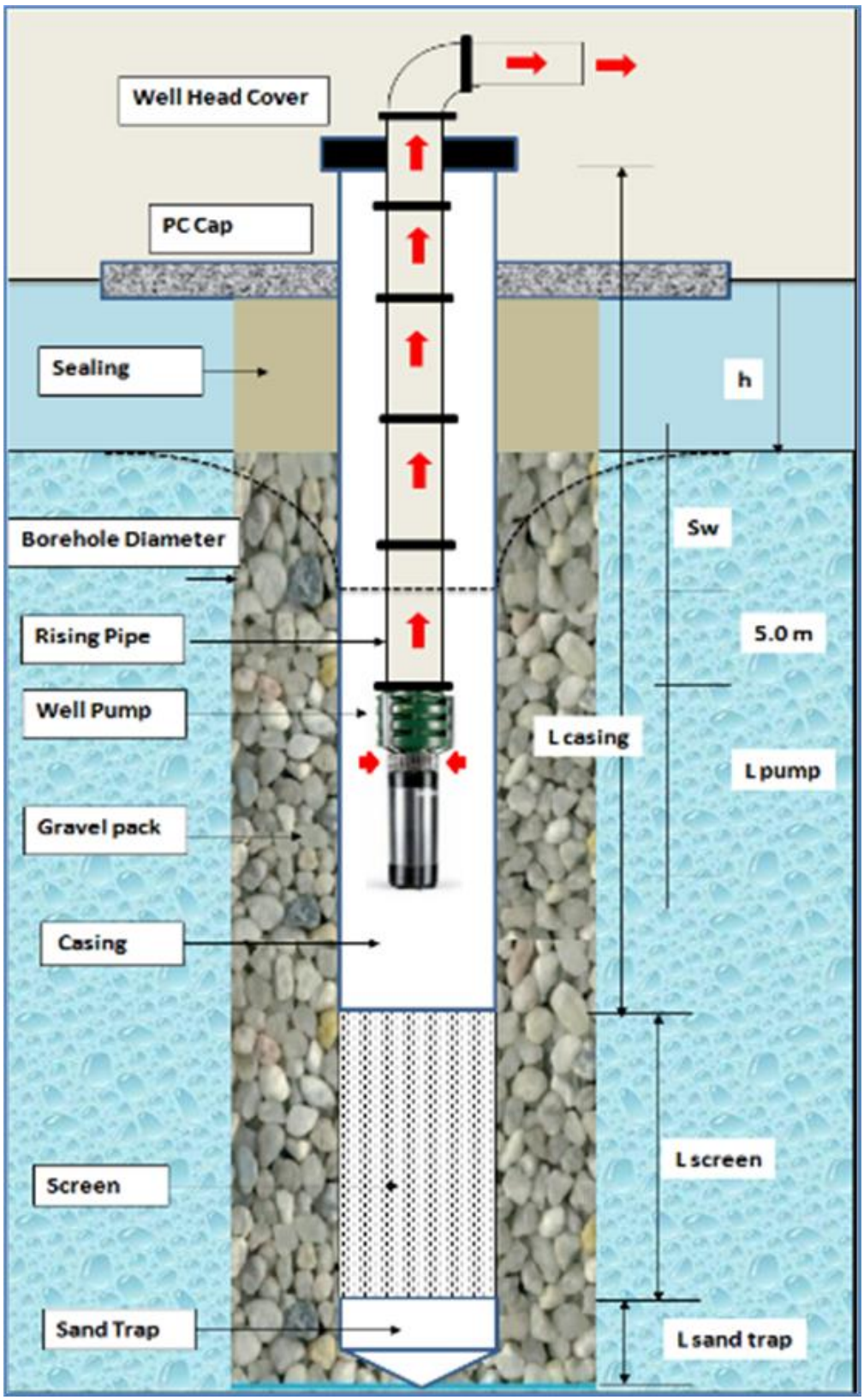


Figure 2-3: Design of a typical shallow well.

2.2.1 Project components

Reference is made to the feasibility study prepared for the project and approved by USAID; the project main components are the following:

a) 500 m^3 desalination plant with all its electro-mechanical and plumbing components. The conceptual design was based on the water salinity concentrations reached within the hydro-geological study and confirmed by a previous study done by the ministry of irrigation and water resources
b) Aquaculture (Fish farm) project to produce about 33 tons/year of grade 2 and 3 fish that will take part in making-up for the reduction of production in North Sinai in the past years, in addition to production of about 17 tons/year of grade 1 fish that will be a candidate for export.
c) salt production using salt ponds depending on the discharge of the brine water from the desalination plant, as well as the discharge of the fish farm.

From a managerial perspective, the desalination plant will be totally managed by the North and south Sinai Company for water and wastewater. Meanwhile, the fish farm will be owned by the government and jointly managed by the government and communal entities formed by the local population while the revenues will be directed towards the welfare of the local population. On the other hand, the salt production ponds will be leased to an investor through bidding procedures while the leasing revenues will be directed towards the welfare of the local population. The following table summarize the main components of the project

Sr.	Title	Objectives	Main Components
1	Construction of groundwater desalination plant	To provide sustainable potable water source for the residents of the village and affiliated communities	- Six shallow water wells - 500 m^3/day R.O. plant - Laboratory, Workshop & Store - Operation and maintenance facilities
2	Fish Farms	To create new job opportunities to at least twenty locals direct, in addition to the benefit from the project revenue to the local community	- Three shallow water wells - Nursery ponds - Production ponds - Solid removal unit - Sedimentation ponds - Operation & maintenance facilities
3	Salt ponds		Numbers of ponds according to the area and rejected water production

The following section is describing in details the Desalination plant components and process

A- **Civil Structure**

1. Raw water storage tank concrete – 1000 m^3.
2. Product water tank – 500 m^3.
3. Reject collection tank – 500 m^3.
4. R.O. (Process) Building - 19 m x 11 m.
5. Standby power Generation unit and MDB Building - 10 m x 5 m.
6. Admin, Laboratory, Warehouse and Workshop Building - 18 m x 5.5 m.

B- **Pretreatment System**

1. Pre-chlorination dosing set (2 dosing pumps, a dosing tank and a mixer).
2. Filter feed/backwash pumps (2 pumps 47 m^3/hr @ 4 bar).
3. Pressure sand filters Carbon steel marine epoxy coated 2.2 m diameter.
4. Pressure activated carbon filter marine epoxy coated 2.2 m diameter.
5. De-chlorination dosing system (2 dosing pumps, a dosing tank and a mixer).
6. Anti-scalant dosing system (2 dosing pumps, a dosing tank and a mixer).

C- **RO skid**

1. Cartridge filter FRP or PVC housing including 20 candles 5 □m, 40 in length.
2. High pressure pump 45 m^3/hr @ 38 bar, with material of construction duplex SS.
3. Turbocharger for energy saving, material duplex SS.
4. 6 RO pressure vessels 8 in, 6 elements, 1200 PSI.
5. RO Seawater membrane 400 ft2, 36 membranes.
6. High pressure piping and valves with material duplex SS.
7. Low pressure PVC 10 bar piping and valves.

D- **Post treatment**

1. Post chlorination dosing skid.
2. Post pH adjustment dosing skid.

E- **Cleaning system**

1. CIP/Flushing system (include 3 m^3 tank, CIP pump 45 m^3/hr @ 3 bar).
2. Permeate transfer pumps - Assumed 20 m^3/hr @ 4 bar.

F- **Electrical and control works**

1. Interconnecting cables.
2. Main distribution panel.

3. Motor control panels.
4. Instrumentation and control panel.
5. Standby generator (250 KVA).
6. External Lighting/internal lighting.
7. Transformer 300 KVA.
8. Earthing system

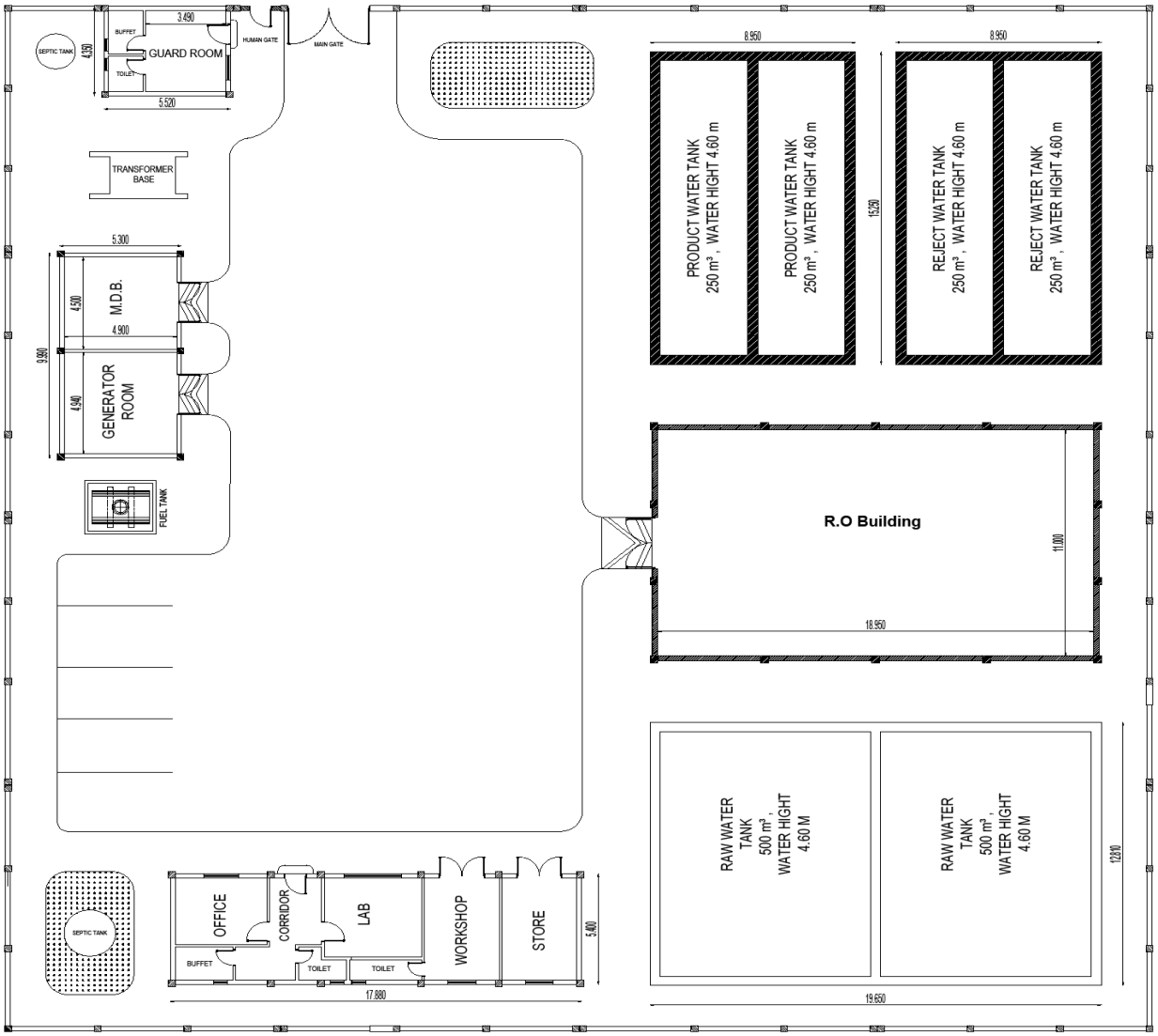


Figure 2-4 Proposed layout of the desalination plant

2.2.2 Desalination plant process Description: -

2.2.2.1 Raw well water

Raw well water from all wells shall be collected in the Raw water tank (1000 m^3) as a single collection point for well water.

- **Pre-Treatment & Filtration**
  Pre-Chlorination Dosing Set
  Chlorine (Na/Ca hypochlorite) shall be dosed to control biological fouling of a reverse osmosis pre-treatment system. If biological contamination is an issue, chlorine can be dosed prior to the pre-treatment system to give a free chlorine residual of 0.2 – 1.00 ppm depending on severity of contamination.
  Chlorine is injected in the inlet pipe of raw water tank to provide contact time to kill and disinfect any existing microorganisms.
  In case in future the wells are deepened and there would be chance of presence of iron and manganese there would be a provision for iron and manganese removal system via chemical oxidation, coagulation precipitation unit with capacity 50 m^3/hr., however it is not normally anticipated that seawater would contain high value of iron and manganese but it may be absorbed by the water from earth layers in deep layers.

- **Filter Feed / Backwash Pumps**
  Filter feed pumps (1 Duty / 1 Standby) are used to boost the raw water from raw water tank after being disinfected to feed multimedia filter and Activated carbon filter and other pre-treatment.

- **Multimedia Filters**
  A multimedia filter is used to reduce the level of suspended solids (turbidity) in process water. The filtration degree of a multi-media filter depends heavily on the filter media and flow (velocity) through the filter.
  Multimedia filters are used to separate particulate solids through its media.
  Backwash cycle comes after a certain time of operation in terms of differential pressure increasing. Backwash pumps are providing the required quantity of water to wash the filter media next.

- **Activated Carbon Filter**
  Activated carbon filters are generally employed in the process of removing organic contaminants Organic substances are composed of two basic elements, carbon and

hydrogen. Because organic chemicals are often responsible for taste, odor, and color problems, and/or extracting free chlorine from water, thereby making the water suitable for discharge or use in manufacturing processes.

- **De-Chlorination (SMBS) Dosing Set**

  It is important to note that chlorine will destroy polyamide thin film composite membranes. It is therefore essential that ALL chlorine be removed from the feed water prior to entering the membranes. Even trace amounts of free chlorine can cause oxidation damage.

  Chlorine can be removed by bisulfate/meta-bisulfite addition or by the use of carbon filters.

  SMBS in injected prior to RO skid to eliminate any chlorine residuals which may damage the membrane elements.

- **Anti-scalant Dosing Set**

  To protect the membranes from scaling; inhibit membrane fouling due to colloids and to maximize the system recovery, anti-scalant is dosed into the feed line.

  Using RO anti-scalant helps to control inorganic scales of calcium, magnesium, barium, stronium, fluoride, iron and silica. RO anti-scalant ensures above 80% reduction in scaling tendencies if used continuously.

- **R.O. System**
  - **Cartridge Filter**

  Outlet water from the multimedia filter will pass through the final filtration step which is the 5-micron cartridge filters.

  This filter includes sediment type melt blown cartridge candles with 5 micron and other pre-treatment to feed RO skid, then this water is pumped to the cartridge filter where particles down to 5-micron size are removed. This is for the protection of the RO membranes and the high-Pressure Pump.

  - **R.O. Skid**

  RO System consists of one skid with one stage with a design capacity up to 500 m^3/day of permeate flow.

  The membranes are only tasked to remove dissolved solids while dividing the feed water into purified water and rejected concentrated salts. The salts and other organics are thrown into the brine stream then flushed into a drain. In the end, we have purified water that has 99 % less dissolved salts.

  The R.O. skid is equipped with an energy recovery device that provides an advantage of power and energy saving by recovering the hydraulic power in the

brine(reject) stream and using this power to increase the feed pressure to RO vessels.
The energy recovery device (turbocharger) saves around 35% of energy consumed at the high-pressure pumps, and decreases the motor size accordingly.

- **Clean in Place (CIP) / Flushing System**

With increased time of plant operation, fouling of the RO-membranes may occur. In most cases the consequence is reduction of product flow and salt rejection. It depends on the quality of the RO-feed. The design includes clean in place (CIP) system for protecting membranes from fouling and a permeate water flush cycle to minimize membrane fouling and piping corrosion during shutdown.
When the membranes reach a certain pressure drop, or the product flow decreases, it will be necessary to clean the membranes. There are two types of CIP processes: acid or alkaline CIP. The first type is required to remove salt scaling in the membranes, whereas the second type is required for fouling removal. The acid solution is typically developed with hydrochloric acid, as it has a better result than other acids like sulfuric acid.
The solution is recycled for a certain time that is determined based on experience and the plant condition. Once the CIP process is over, the chemical solution will be pumped by the concentrate pump towards the reject tank.
Also, this system is used for flushing using permeate water to remove salt scaling at each start and shutdown of the plant.
Flushing is a once through system where flushing water is wasted to drain and it runs for 5-10 minutes.

- **Post treatment**

RO permeate is finally treated and tuned by pH adjustment dosing and disinfection on the way to product water tanks so it can be suitable for potable use.

- **Product water collection**

The permeate water from RO plants, will be collected in the product tank (500 m^3)
Water distribution to truck connections or city network shall be via permeate booster pumps. Disposal of the final discharge of brine water.
Reject and backwash waste from the RO plant will be directed to reject water collection tank, and then it will be transferred to the fish farm and the salt ponds.

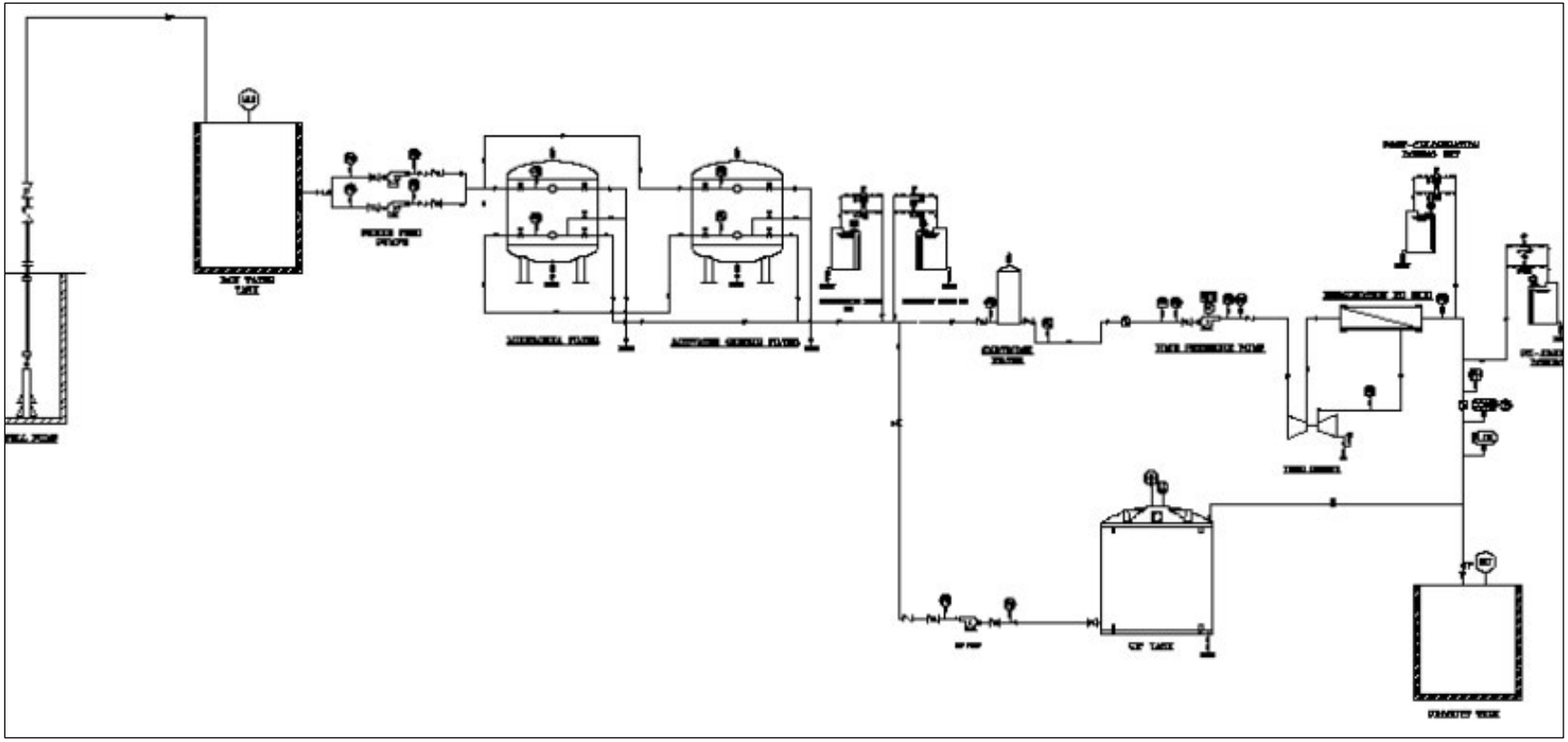


Figure 2-5 Summary of the desalination processes

2.4 The aquaculture plant consists of the following main components:

2.4.1 Farm design and components

The proposed farm design considered the efficient use of land and water resources. The following section discusses the suggested layout for the different farm sections/ components. As the farm site is low land, all ponds will be above the ground. Water will be pumped to ponds and drained by gravity to the sedimentation tank. From there, water will be pumped to either forage crop cultivation or salt production lakes (operated by members of the local population).

Figure 2-6 shows layout of the farm and the different project components as follows:

- Office and residence and fish marketing buildings
- Nursery ponds
- Production ponds
- Solid removal unit
- Sedimentation ponds
- Security rooms
- Solar cells area
- Water pumping area.

The following sub-sections discuss in detail the different components of the proposed fish farm.

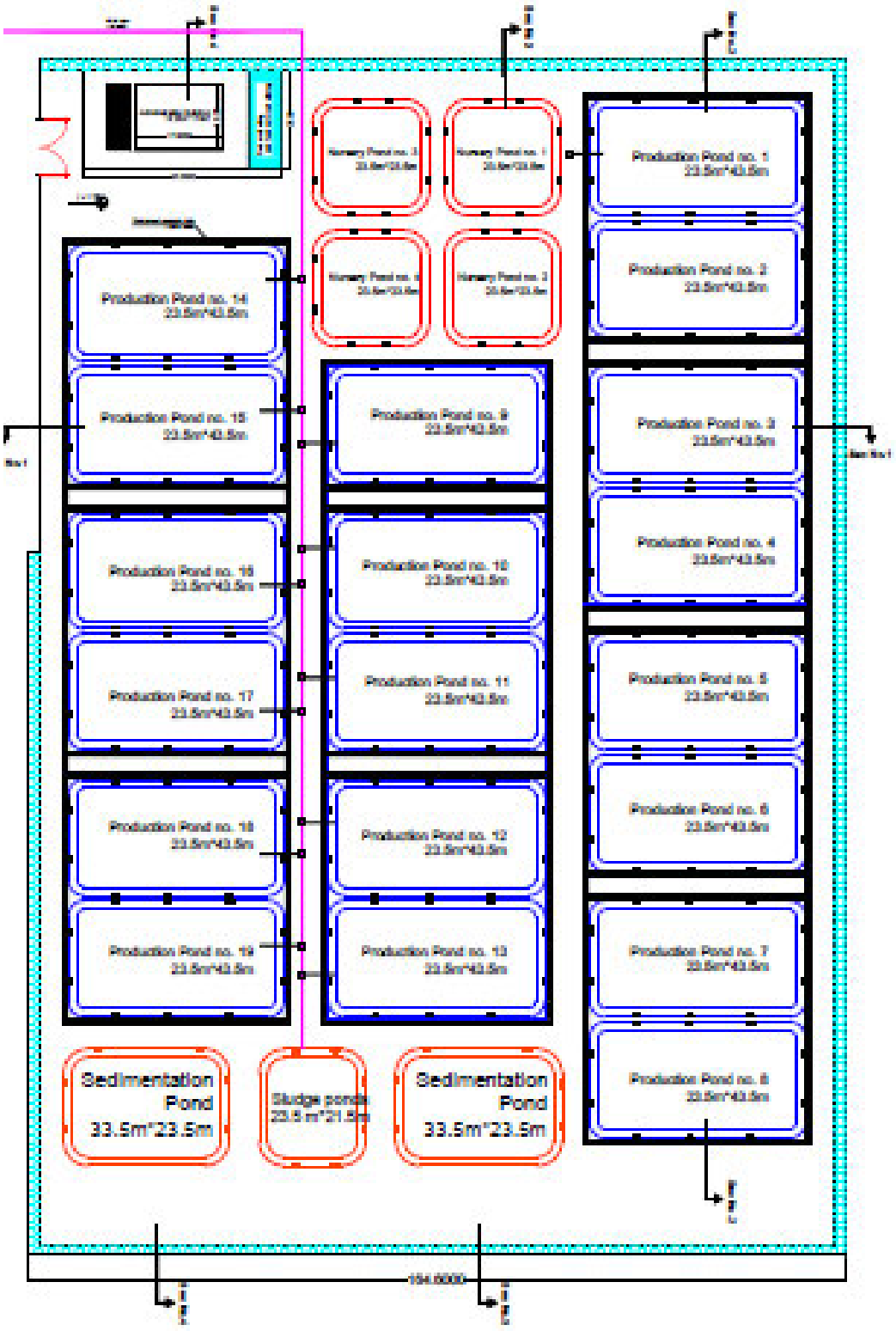


Figure 2-6 Fish Farm Layout.

2.4.2 *Office & residence and marketing buildings*

General layout for the buildings is illustrated in **Figure 2-7**. The two main buildings are the office and residence and marketing. The office and residence building shown in **Figure 2-8** is designed to be an office for the farm management activities and visitor receiving. The residence facility attached to the office is equipped for a very limited number of farm staff who should stay overnight for work supervision or emergency stay of project visitor (eg. consultant or technical support member). The total building is located at the project entrance area. Car parking is attached to the building for staff and visitor cars.

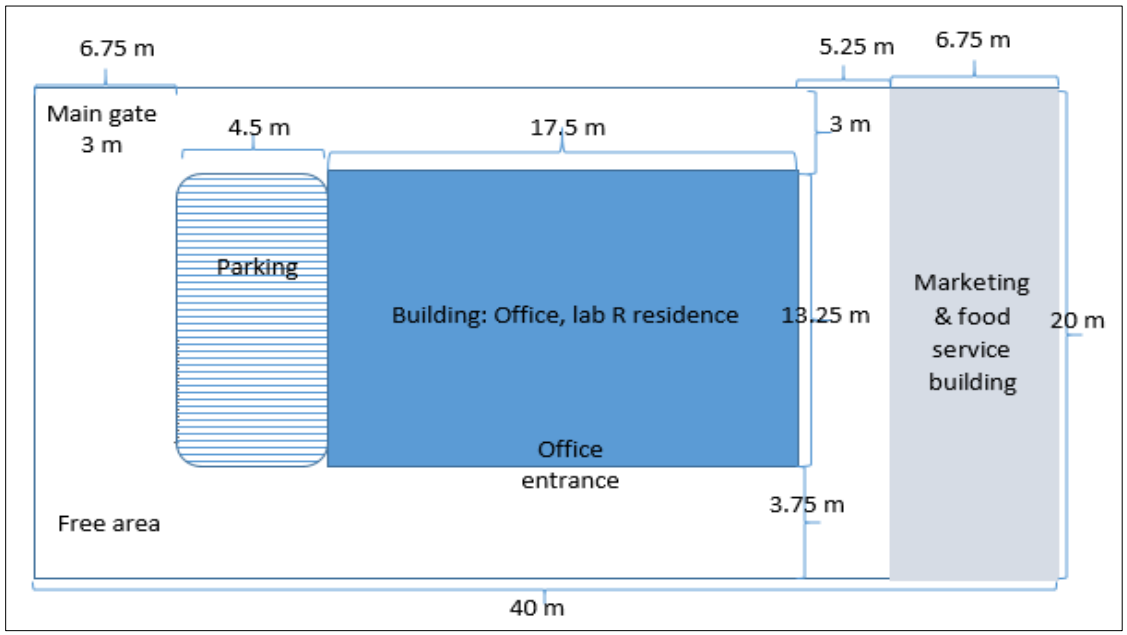


Figure 2-7 Building area layout

The marketing building shown in **Figure 2-9** is important for fish sorting, grading and packaging. The main purpose of the facility is to enable very good handling and packaging practice to farm products to meet the good market quality standard. The building is designed to provide a good work environment, hygiene and flow of fish products from one side to the other side of the building. The fish selling shop and food service are incorporated into the building. The fish shop and food service shop aim to provide service to the village community people to make the project serve the village and generate income for the project, when they work around the year.

- Fish receiving tank is 3.75 m x 2 m shaded open area for car parking
- Washing tank is 2 m length, 1 m wide and 0.5 m depth.

- Cooling tank is 1 m x 1 m x 0.7 m
- Sorting and grading table is stainless steel table with 4 outlets open one per corner 3 m x 1 m and 1 m height.
- Packaging table is stainless steel table 3 m x 1 m and 1 m height.
- Weighing and labeling table is 2 m x 1 m stainless steel and 1 m height.

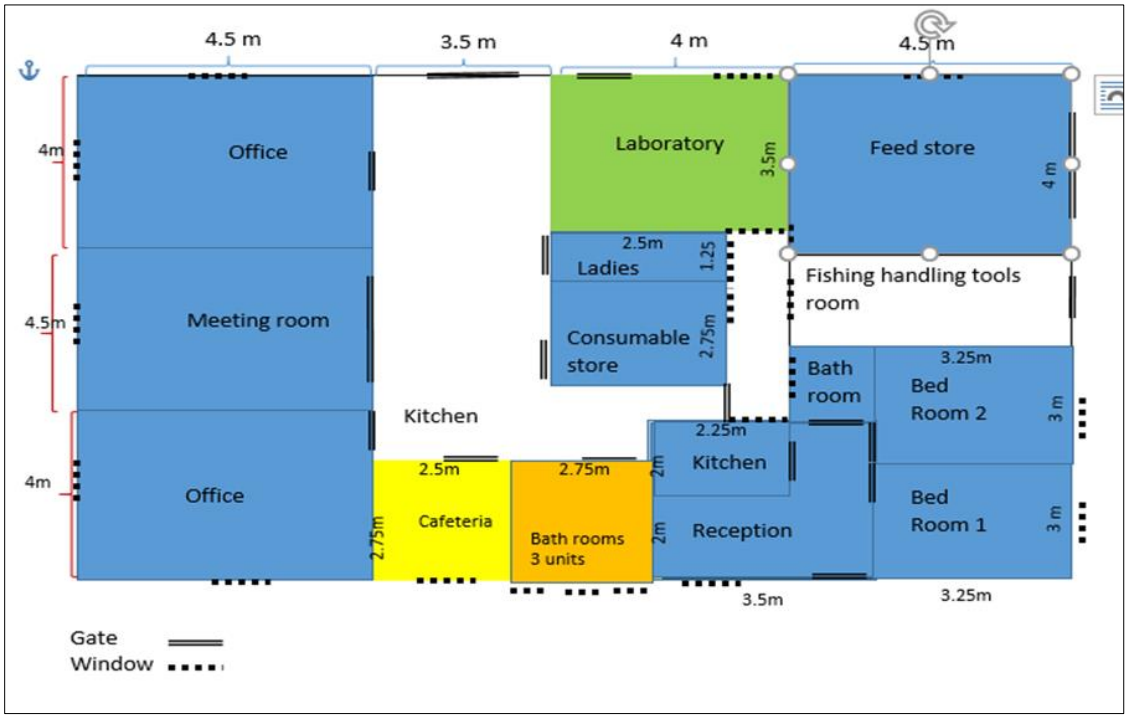


Figure 2-8 Layout of office and residence building

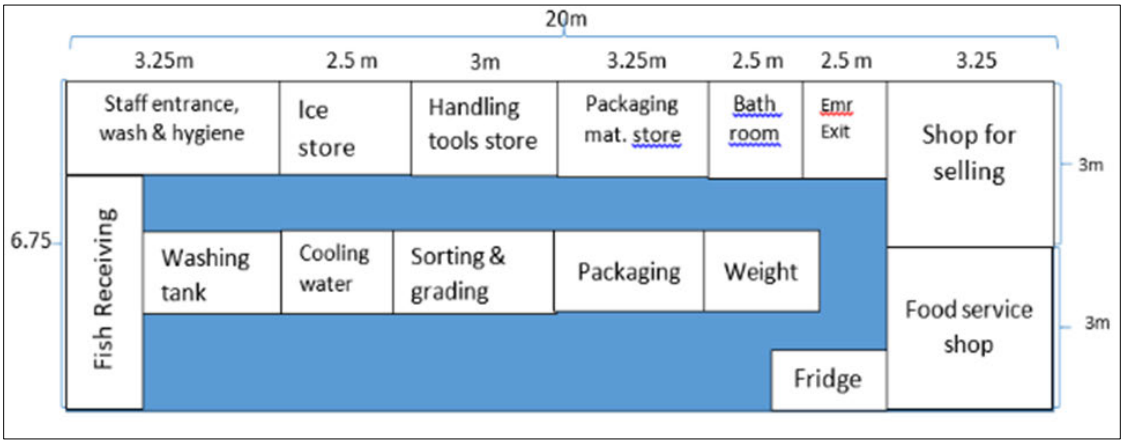


Figure 2-9 Fish marketing and food service building.

2.4.3 Nursery ponds

Four nursery ponds for rearing fish fry (small size fish) to fingerlings phase are located next to the office building. The nursery ponds shown in **Figure 2-10** will receive the fish from outside (hatcheries or wild sources) and rear them to fingerlings stage before stocking in production ponds. Keeping fry in nursery ponds saves growing duration in production ponds. Each nursery pond is (20 m x 20 m) and 1.25 m depth, 500 m^3 water holding capacity. The pond surface area dimension is 23.5 m x 23.5 m, due to the slope of the banks. Pond banks slope is one to one. And the bottom has a slope 1% towards the drain area.

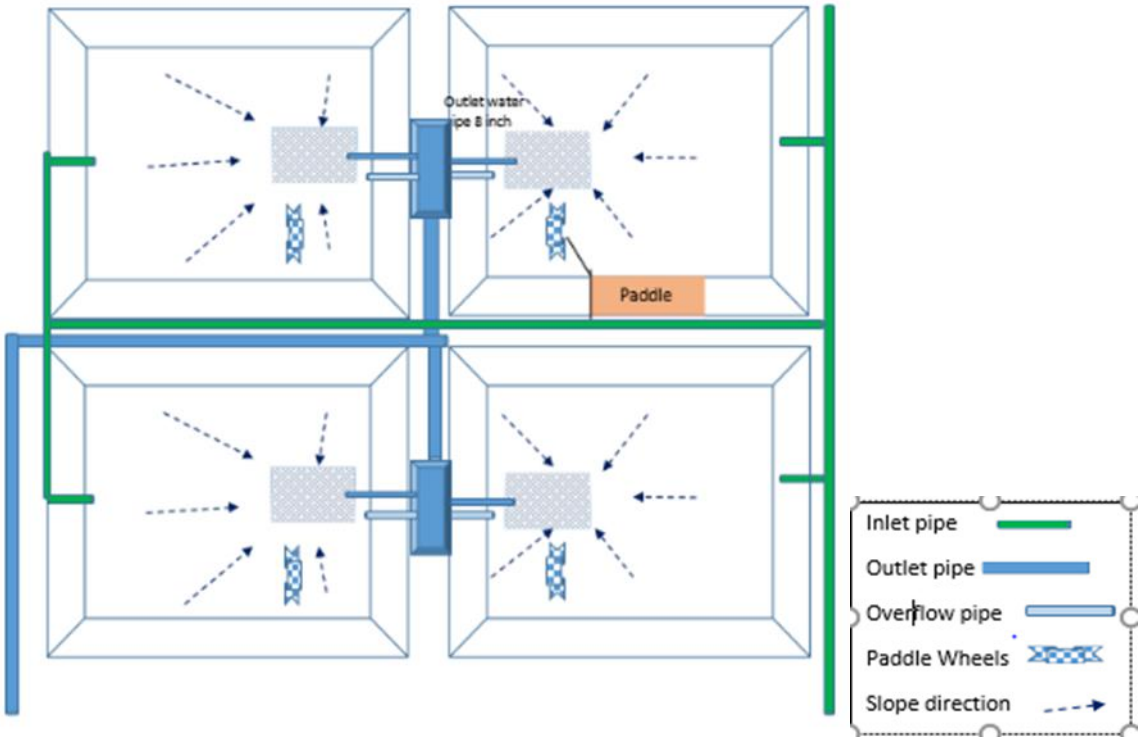


Figure 2-10 Layout of nursery ponds

2.4.4 Production ponds

The farm will consist of 19 ponds for commercial production of fish. All ponds will be lined with the polyethylene sheet 1500 micron to reduce investment cost. The production pond shown in **Figure 2-11** is rectangular in shape with water holding capacity 1000 m^3. The pond dimension is 40 m length, 20 m wide and 1.6 m depth (average water level in the pond is 1.25m). The pond dimension from the surface is 43.5 m in length and 23.5 m wide

due to the slope of the banks. The bank slope will be limited to 1 by 1 due to the protection of the banks by the polyethylene sheet as shown in **Figure 2-12**.

The pond bottom is to be designed with a 1% slope towards the middle from both sides and slope to the drainage pipe. Every pond will have a water inlet pipe connected to an irrigation network and a drainage pipe connected to a drainage network.

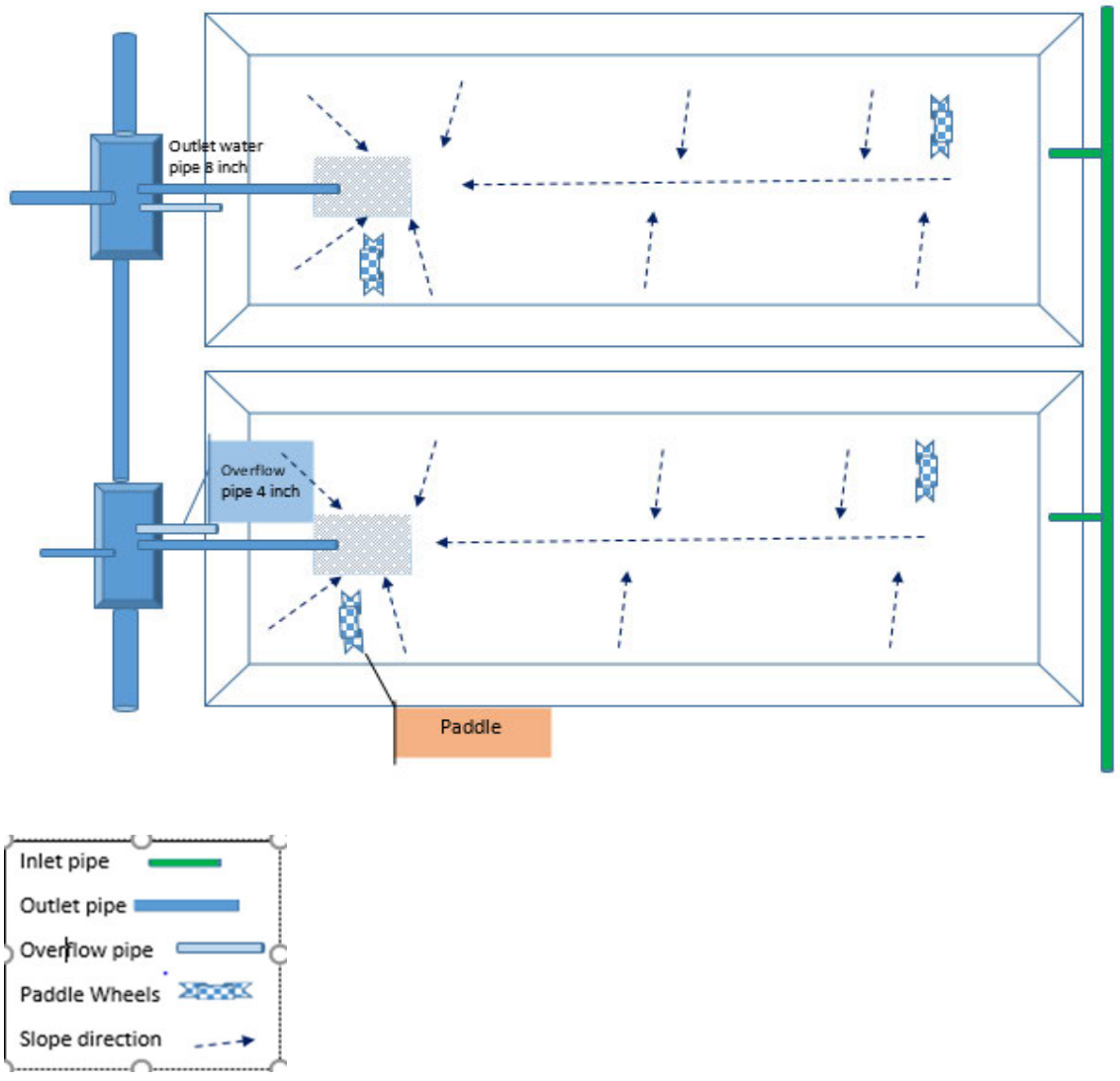


Figure 2-11 Top view of two adjacent production ponds.

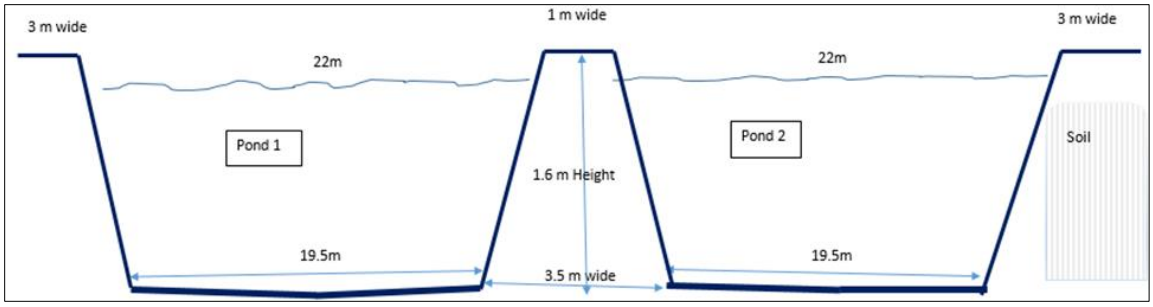


Figure 2-12 Cross section in two adjacent polyethylene ponds.

2.4.5 Solid Removal Units

Solid removal unit job is to remove suspended solids that are generated during fish production from pond water effluent. Also, this process will enable using farm effluent through drip irrigation systems in case of using farm effluent water for crop irrigation. The unit consists of two sub-sections; drum building unit; sludge concentration area. The drum filter is a mechanical filter that removes solid waste according to the mesh of filter screens as shown in **Figure 2-13**. The recommended screen mesh is to collect a solid more than 50-micron size. Drum filter water flow capacity varies according to many factors including the mesh size. The recommended is to allow water flow at 30 m^3/hr. The drum filter will be imported or sourced from local agents as this device is not produced on commercial scale in Egypt. The drum filter will be fixed in a building about 3 m wide, 4 m in length and 1 m high. Detail specification of the construction is to be decided according to purchased drum filter specifications. The drum filter is equipped to do self-cleaning automatically and concentrate sludge and throughout water current. This is very important to reduce pollution generated by fish farming and minimize the impact of aquaculture on the surrounding environment. Sludge collected by the drum filter will be collected into a small pond/tank to allow water drying and removing out as fertilizers for surrounding farms. The sludge concentration areas will consist of three separate rooms, to be used in rotation to allow sludge drying.

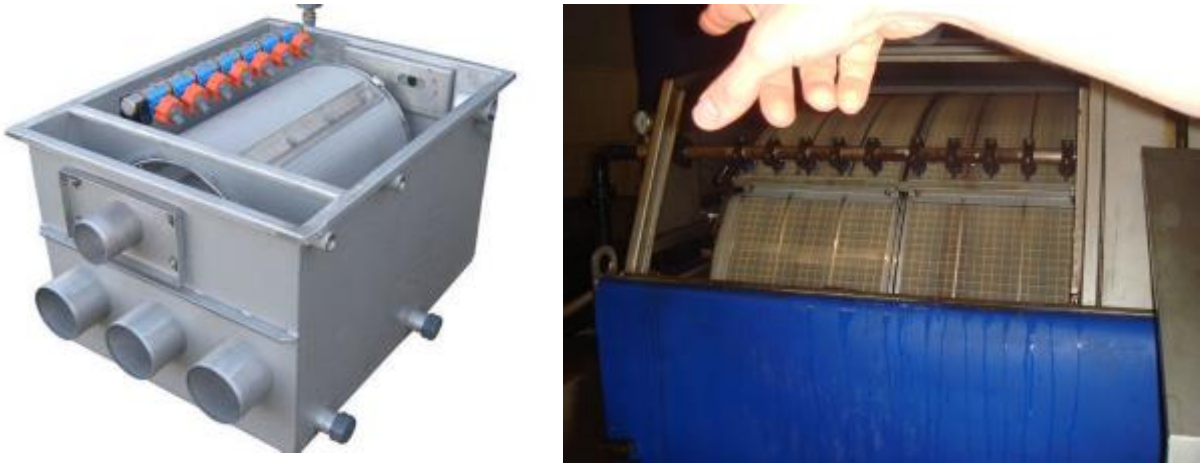


Figure 2-13 Pictures for drum filers in use in solid removal in intensive farms.

2.4.6 Sedimentation ponds

The purpose of establishing sedimentation ponds is to allow for the reduction of ammonia gases and other gases in farm effluent water before disposal or use in crop irrigation. The sedimentation ponds are three ponds as shown in **Figure 2-14**. Sedimentation ponds 1 and 2 are the same size (30 m long x 20 m wide and 1.25 m deep), while pond 2 is 18 m x 20 m x 1.25 m. From settling ponds three water is to be pumped out for either use in irrigating salty plants or flush to salt lakes for evaporation and salt production. The recommended plant for growing on salt water are Mangrove which can help in absorption of salt from the water. Also, the recommended other plants are Atriblex (forage plan) and Jojoba (oil crop).

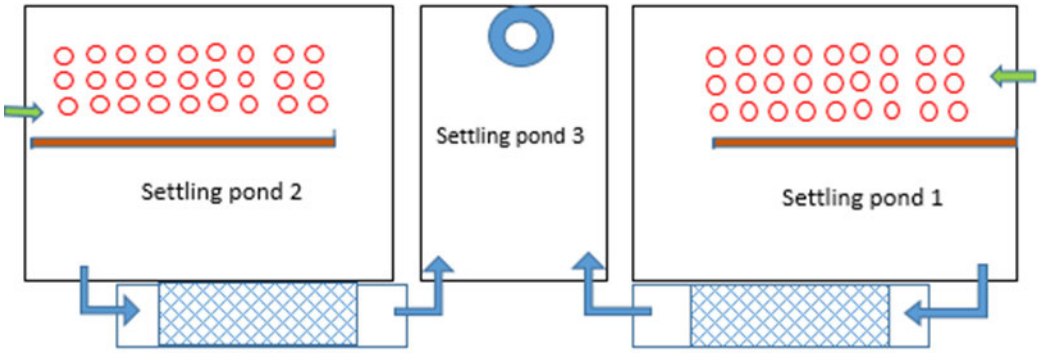


Figure 2-14 Overview of sedimentation ponds.

In order to improve effluent water quality and reduce turbidity in effluent water, water will be treated aeration and secondary treatment before pumping to salt production. Every sedimentation pond will be split by suspended wall longitudinal to allow water to move in one direction and return from the other to outlet pipe. Aeration network will be fixed on one side of the pond for reducing the biological oxygen demand on water before allowing water to move to the secondary settling tank. The aeration network consists of air diffuser plate 25 cm wide every two-meter 30 units total. The air diffuser plates will be connected through PVC pipe to a 3 hp air blower on the bank side and fixed around 1m below the water surface.

The secondary sedimentation tank is 3 m wide, 1 m deep and 20 m long. The secondary sedimentation tank role is to be clarifier to reduce water turbidity in the tank. The tank design allows water to settle at the entrance. Water goes through the screen to settle polyethylene construction/block to reduce water velocity and settle suspended solid in water. Another screen will be 1 m before the end of the tank. Water will move from the far end of the tank to the pond in the middle for pumping to the salt production area. The secondary treatment tank will be covered with a dark shading sheet to reduce light penetration to water.

2.4.7 Security Rooms

Security rooms are required in three corners of the farm for the security people to stay inside at night. Recommend room open from three directions lick a tent 3 m x 4 m x 3 m. It can be just limited to shading areas to protect from the sun and rain. Further to this there should be security cameras to monitor activity in the farm at night time.

2.5 Salt ponds and Salt Production

As mentioned in the desalination plant conceptual design, the reject water is highly saline with an expected salinity of 64,000 ppm. According to a study on the possible production of salt from this reject water, the high concentration of salts makes this water a perfect candidate for salt production. Salt production will be performed through existing salt ponds with a 27,0000 m^2 total area of ponds needed for vaporization of the water. This process is mainly dependent on the chemical analysis of the saline water that would determine the amount of saline water that could be sent to the salt ponds for salt

production from the desalination plant and that from the fish farm. The total salt production is expected to be 15,000 ton/year with an expected annual profit of 900,000 EGP/year. Another factor that makes this alternative a highly recommended one is the fact that a large number of the targeted population in El-Roda village and its vicinity are already working in the salt production industry with a long experience in that field.

As the site location is very near to the salt ponds, a significant part of the highly-saline reject water will be pumped to these salt ponds that are already being functioning and used in salt production by a large portion of the local population. Hence, the local businesses working in the salt industry will directly benefit from the saline reject water bi-product.

The major portion of the reject water will be used to produce salt in the neighboring salt ponds creating the utmost use from each cubic meter of water with an annual production of 15000 ton of salt with expected annual profits of about 900,000 EGP.

3. Project Framework

3.1 Egyptian Environmental Requirements

The Environmental Scoping study is governed by the Law No. 4 of 1994 and its amendments by law 9 of 2009 and law 105 of 2015, the Law on Protection of the Environment and its Executive Regulations 1995 and its amendments (Decree No. 1095/2011, 710/2012, 964/2015). According to Law 4 of 1994, applications for a license from an individual, company, organization or authority, an assessment of the likely environmental impacts of development projects should be undertaken. An ESIA is required for all development projects including the desalination projects.

Based on the categorization of development projects included within the Guidelines for EIA issued by the EEAA in 2009, and amended in 2010, compact desalination plants projects in addition to fish farm are considered under Category B projects (projects with potential impacts) which require undertaking a full ESIA. The ESIA process is stipulated in the figure below.

The key requirements for a full ESIA as per the requirements above include the following:

- Environmental and Social (E&S) Regulatory and Legal Review
- Project Description
- Description of the Baseline Environment (physical, biological, social)
- Identification and Analysis of Impacts
- Analysis of Alternatives
- Public/stakeholders Consultation
- Environmental Management Plan (EMP) (mitigation measures, monitoring program, institutional arrangements)

Upon submission of the ESIA report to the CAA in charge of issuing licences, the CAA will send the ESIA to EEAA for evaluation. The EEAA shall review the ESIA and provide comments or feedback within 30 days, and then issue their opinion to CAA. The CAA in charge of issuing licences in case of desalination plant projects is the WWHC, and for the fish farm is the Governorate.

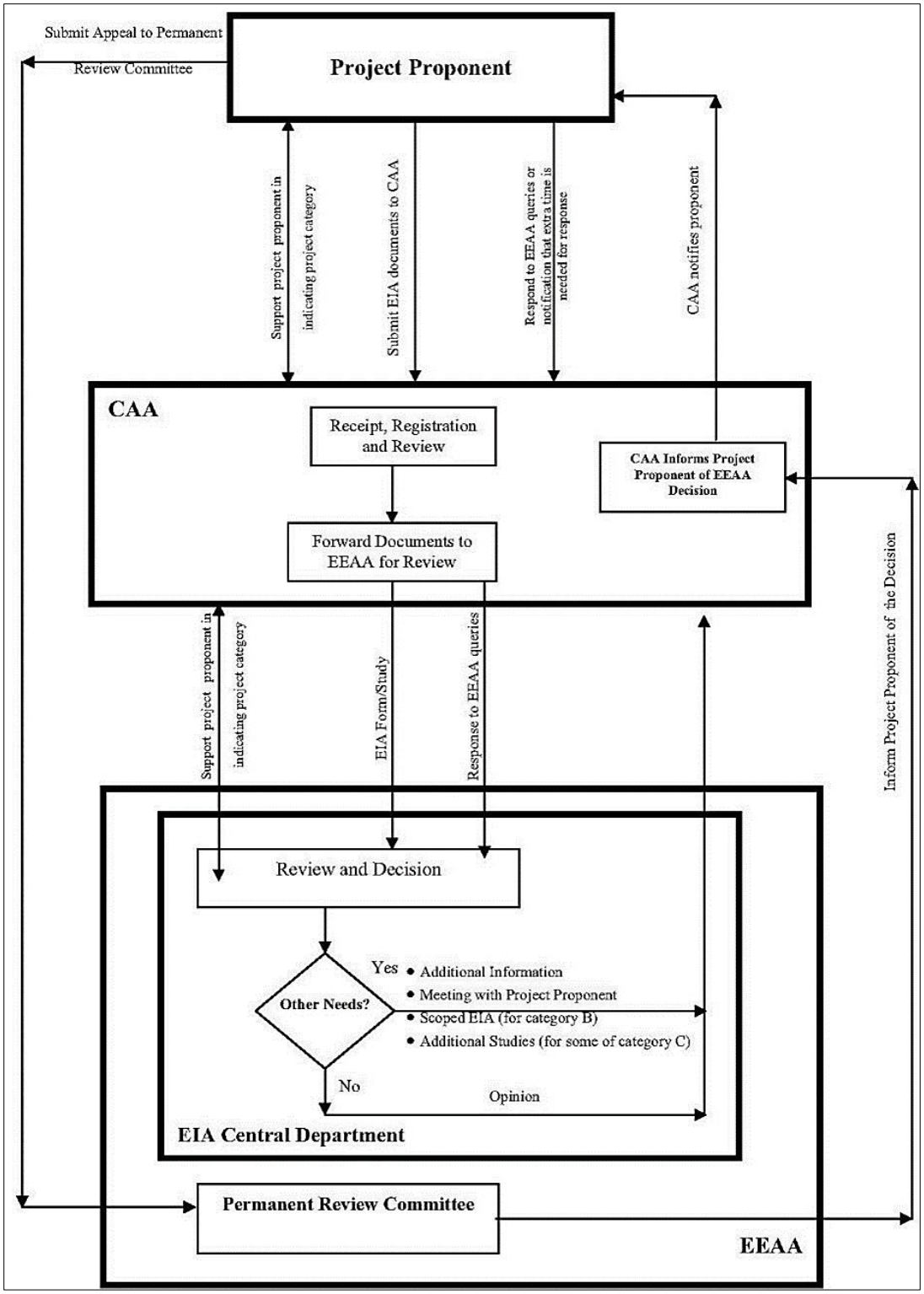


Figure 3-1 ESIA Process Followed for Development Projects in Egypt, (EEAA EIA Guidelines, 2010)

3.2 Egyptian E&S Regulatory Context

This section lists those legislations that are directly related to environmental and social compliance that must be adhered to by all parties involved in the Project throughout the planning and construction, operation, and decommissioning phase. These legislations include: (i) those issued by EEAA (laws, regulations and instruction), and (ii) the relevant national legislations issued by other line ministries (laws, regulations, instructions, standards), in addition to the USAID requirements.

Table 3-1 lists the key relevant legislation to each of the environmental and social parameter being studied and assessed in details within the ESIA report.

Table 3-1: National Legislation and Guidelines Governing the E&S Compliance for the Project

Legislation
Land Use
Electricity Law 87/2015
Law 10/1990
Law 577/1954
Civil code 131/1948
Unified Building Law No. 119 of year 2008
Geology, Hydrology, Hydrogeology
Law 4/1994 Law 33 of 2002 related to the water bodies in Egypt, that define the ground water, surface water, and Canyons and torrents.
Management of Solid Waste, Hazardous Waste and Wastewater
Law 4/1994 amended by Law 9/2009 and ER 1095/2011 amended by Decree 710/2012)
Ministerial Decree 44/2000, Decree of Law 93/1962
Biodiversity, Birds, and Bats
Law 4 of 1994
Environmental Impact Assessment Guidelines and Monitoring Protocols for Wind Energy Development Projects along the Rift Valley/Red Sea Flyway with a particular reference to wind energy in support of the conservation of Migratory Soaring Birds (MSB)
Archaeology and Cultural Heritage
Law 117/1983
Air Quality and Noise
Law 4/1994 amended by Law 9/2009 and ER 710/2012
ERs (amended by Decree 1095/2011 amended by Decree 710/2012) which include maximum limits of ambient air pollutants and noise emissions
Modified ERs (710/2012) of Law 4/1994
Law 4/1994
Law 4/1994 and its modified ERs

Infrastructure and Utilities
Petroleum pipelines Law 4/1988
Occupational Health and Safety
Law 4/1994
Law 12/2003 on Labour and Workforce Safety
Law 12/2003 on Labour and Workforce Safety and Book V on Occupational Safety and Health (OSH) and assurance of the adequacy of the working environment
Law 137/1981
Decree 458/2007
Socio-economic
Law 94/2003
EEAA EIA guidelines

3.3 International Agreements

Egypt has signed and ratified a number of international conventions committing the country to the conservation of environmental resources and protection of workers' health & safety and labour rights. The following Table lists the key conventions:

Table 3-2: Relevant Egyptian International Conventions and Agreements

Name of Multilateral Environmental Agreement	Date
Biodiversity and Natural Resources	
International Plant Protection Convention	1951
Agreement for the Establishment of a Commission for Controlling the Desert Locust in the Near East	1965
Convention on Wetlands of International Importance Especially as Water Fowl Habitat (RAMSAR)	1971
Convention Concerning the Protection of the World Cultural and Natural Heritage	1972
Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES)	1973
Convention on the Conservation of Migratory Species of Wild Animals	1979
Protocol to Amend the Convention on Wetlands of International Importance Especially as Water Fowl Habitat	1982
Convention on Biological Diversity (CBD)	1992
Agreement for the Establishment of the Near East Plant Protection Organization	1993
United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa	1994
Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean	1995
African Convention on the Conservation of Nature and Natural Resources (revised)	2003
International Tropical Timber Agreement	2006
Hazardous Materials and Chemicals	

Convention Concerning Prevention and Control of Occupational Hazards Caused by Carcinogenic Substances and Agents	1974
Convention on the Prohibition of the Development, Production and Stock-Piling of Bacteriological (Biological) and Toxin Weapons, and on their Destruction	1972
Protocol on the Prevention of Pollution of the Mediterranean Sea by Transboundary Movements of Hazardous Wastes and their Disposal	1976
Convention on the Prohibition of Military or any other Hostile Use of Environmental Modification Techniques	1976
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal	1989
Bamako Convention on the Ban of the Import into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa	1991
Amendment to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal	1995
Stockholm Convention on Persistent Organic Pollutants (POPs)	2002
Atmosphere, Air Pollution and Climate Change	
Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space Including the Moon and Other Celestial Bodies	1967
Vienna Convention for the Protection of the Ozone Layer	1985
Montreal Protocol on Substances that Deplete the Ozone Layer	1987
(London) Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer	1990
United Nations Framework Convention on Climate Change	1992
(Copenhagen) Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer	1992
Kyoto Protocol	1997
Paris Agreement under the United Nations Framework Convention on Climate Change	2015
Health and Worker Safety	
International Labour Organization Core Labour Standards	1936
Convention Concerning the Protection of Workers Against Ionizing Radiation	1960
Convention Concerning the Protection of Workers Against Occupational Hazards in the Working Environment due to Air Pollution, Noise and Vibration	1977
Occupational Safety and Health Convention	1979

3.4 USAID Environmental Requirements

USAID proposes to fund Water related Program. Activities identified for such funding are subject to the Environmental Procedures established by Title 22 of the U.S. Code of Federal Regulations, Part 216 (22 CFR 216). Pursuant to those Procedures, actions that have a potential for significant impact within a country require the preparation of an Environmental Assessment (EA) and subsequent approval of the EA and its recommendations to avoid or otherwise mitigate potential adverse impacts.

These procedures: 1) provide advance notice that certain types of projects will automatically require detailed environmental analysis thus eliminating one step in the former process and permitting early planning for this activity; 2) permit the use of specially prepared project design considerations or guidance to be substituted for environmental analysis in selected situations; 3) advocate the use of indigenous specialists to examine pre-defined issues during the project design stage; 4) clarify the role of the Bureau's Environmental Officer in the review and approval process, and 5) permit in certain circumstances, projects to go forward prior to completion of environmental analysis

The Procedures determined 11 classes of actions as having potential for significant environmental impacts. They are as follow:(i) Programs of river basin development;(ii) Irrigation or water management projects, including dams and impoundments;(iii) Agricultural land leveling;(iv) Drainage projects;(v) Large scale agricultural mechanization;(vi) New lands development;(vii) Resettlement projects;(viii) Penetration road building or road improvement projects;(ix) Power plants;(x) Industrial plants;(xi) Potable water and sewerage projects other than those that are small scale. The initial component of the EA process is to prepare a Scoping Study.

4. Scoping Objectives

The objective of this Scoping Statement is to summarize the results of scoping process that has been conducted to identify significant environmental issues related specifically to the project.

22 CFR 216.3 stipulated that the objectives of Scoping Statement are as follow:

- A determination of the scope and significance of issues to be analyzed in the EA or Impact Statement, including direct and indirect impacts of the project on the environment.
- Identification and elimination from detailed study of the issues that are not significant or have been covered by earlier environmental review, or approved design considerations, narrowing the discussion of these issues to a brief presentation of why they will not have a significant effect on the environment.
- A description of:
    - The time plan of environmental analyses preparation, reflecting project phases (construction – operation)
    - Variations required in the format of the EA
    - Description of how the analysis will be conducted and the disciplines that will participate in the analysis.

Scoping statement will be reviewed and approved by the USAID Environmental Officer representative.

4.1 Updated work plan

Reference to the technical proposal, the consultant provided a detailed work plan for the implementation of the scoping statement report, as well as the Environmental and social impact assessment study ESIA. As agreed, the ESIA Study will be finalized and Final Reports will be prepared over a period of 12 weeks (one week = 5 working days). The following chart illustrates the updated schedule based on the completed activities, and the output deliverables that will result accordingly.

The project is expected to be constructed in 2022 and the efficient life-span of the facility is reasonably expected to be 15 years. Hence the population to be served by the end of phase 1 of the plant was calculated to be the population in 2037.

No	Activities	Deliverables	Weeks											
			1	2	3	4	5	6	7	8	9	10	11	12
1	Mobilize the team and conduct the Kick off meeting													
2	Conduct a Site Reconnaissance Visit and conduct the scoping meetings with the main stakeholders													
3	Review the relevant regulations													
4	Review all the available data and the feasibility study													
5	Identify Relevant Environmental and Social Aspects													
6	Preparation and Submission of the scoping statement report.	**Scoping Statement Report**												
7	Site visit to collect the detailed information, conduct the detailed baseline survey, and conducting the environmental measurements.													
8	Data Review and prepare the baseline survey report, and synthesize impacts of the project.													
9	Analysis and assessment of Environmental and Social Impacts													
10	Analysis of Alternatives													
11	Propose mitigating measures to rectify negative impacts													

No	Activities	Deliverables	Weeks											
			1	2	3	4	5	6	7	8	9	10	11	12
12	Develop an Environmental & Social Management Plan (ESMP)													
13	Prepare a Draft Environmental Impact Assessment													
14	Submit a Draft EIA Report for Review	Draft Environmental Impact Assessment Report Submitted												
15	Draft ESIA Report reviewed and edited by the project owner	Comments provided to Consultant												
16	Preparation and conducting the Public Consultation Event	PC event												
17	Prepare and Submit the Final ESIA Report	Final Environmental Impact Assessment Report												

	Activities					
	Deliverable					
	Milestone					
	Completed					

5. Baseline Description

Most of the residents in El-Roda Village work in the field of handicrafts and simple trade, and they work in the production of industrial salt from well water. A handicraft project for women, especially widows, was funded by the United Nations Program

The dominant activities of the residents are handicrafts activities, simple trade, and salt ponds that are spreading to the South and West of the village for production of industrial salt from well water. This chapter includes the environmental baseline conditions at the project's area of influence. The Consultant has reviewed available literature, public sources and visited the site and its surrounding area. This chapter makes extensive and direct use of information on the physical environment; biological environment and socio-economic.

5.1 Project Location

The land available for the whole project as agreed with Bir El Abd City District Chairman. on the North of the main road between Bir El-Abd and EL Arish. El-Roda is halfway between EL Arish and Bir El Abd. The geographical location of the project site is ideal to give opportunities for marketing of project products in the same village or markets in EL Arish and/or Bir El Abd as shown in **Figure 5-1**

El-Roda village is located 6 km to the south of the Mediterranean Sea and at the middle distance between Bir El Abd and El Arish City. The project area is located to the north east direction of the existing residential area.

Table 5-1 The coordinates of the Project area

Point	Coordinates	
	N	E
A	31° 2'26.25"	33°20'25.03"
B	31° 2'18.42"	33°20'26.58"
C	31° 2'17.82"	33°20'20.39"
E	31° 2'22.40"	33°20'19.05"
F	31° 2'22.15"	33°20'17.17"
G	31° 2'25.40"	33°20'16.57"

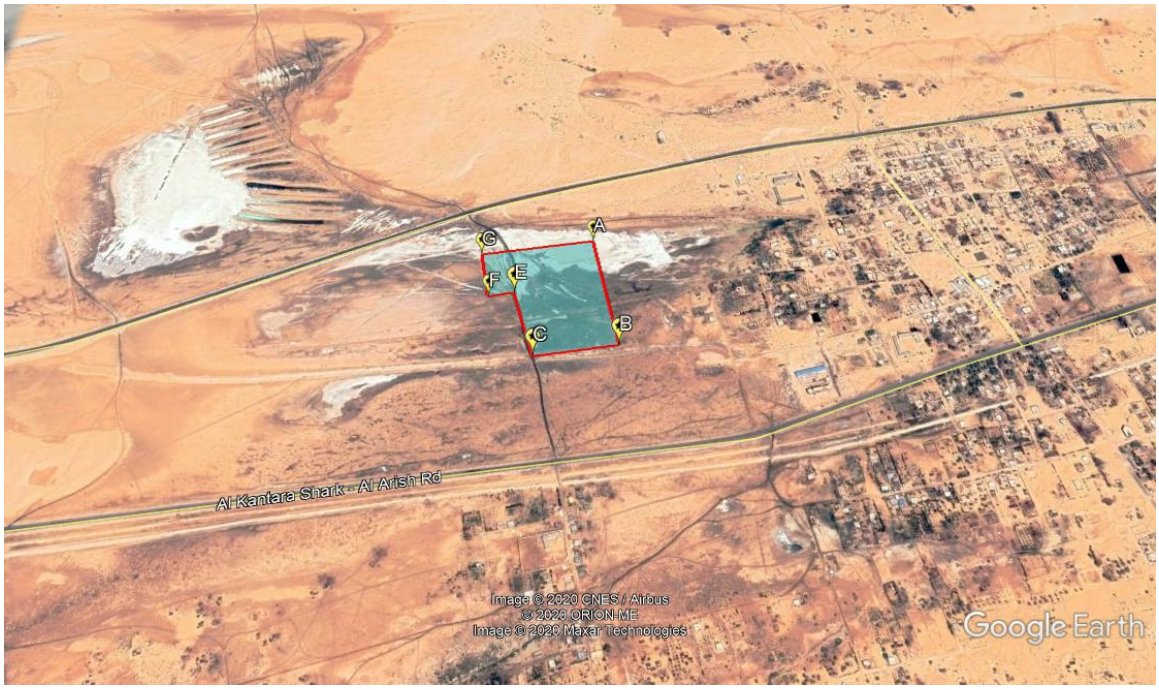


Figure 5-1 Project boarders

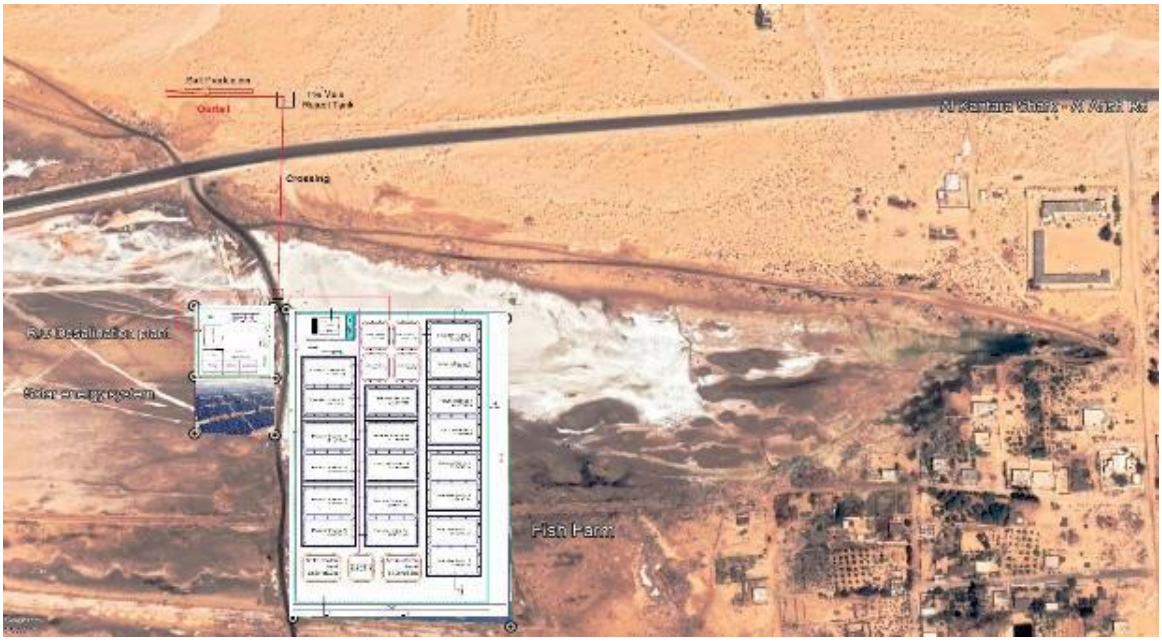


Figure 5-2 The general layout of the designed projects on google.

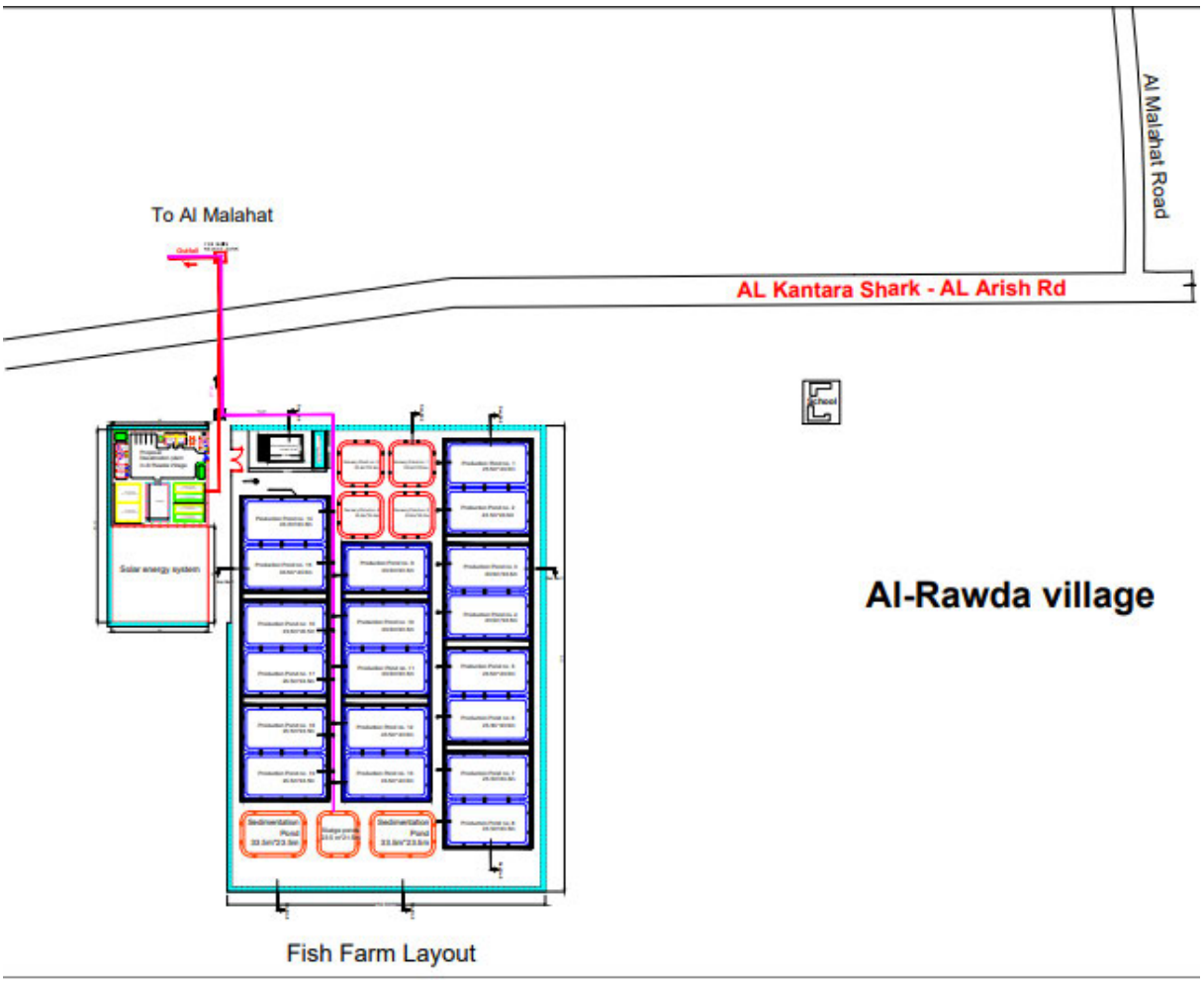


Figure 5-3 The general layout of the designed projects

The proposed site is surrounded by the main road (EL Arish, EL Arish Bir El Abd) from the North, El-Roda village from the east, secondary road from the west and free land then village road from the South. The site is in the west of the village and close to the school and Masjeed.

The project very near to the main road and unused publicly, with an area sufficient enough for the project. Additionally, it is also believed to be more suitable for the project as it is beside existing salt ponds in which part of the brine water could be discharged in addition to being on a leveled grade which means that the earthwork will be minimal.

The geographical location of the project site is ideal to give opportunities for marketing of project products in the same village or markets in EL Arish and/or Bir El Abd.

Lands required for the project are:

- Total land allocated for the project is 45,767 m^2
- Total area for the Water desalination project will use 5,000 m^2
- Total area for the aquaculture component 39,767 m^2

5.2 Environmental Baseline

This part of the study includes the environmental baseline conditions at the project's area of influence. The Consultant has reviewed available literature, public sources and visited the site and its surrounding area. This chapter makes extensive and direct use of information on the physical environment; biological environment and socio-economic.

5.2.1 Physical Environment

5.2.1.1 Climatic Conditions

North Sinai occupies a semi-arid desert where the annual rainwater amounts falling in far northern zone at Rafah and El Arish are less than 200 mm. During winter, the rainwater falls in form of sprinkles which approaches its maximum amount in January and December While in spring; it decreases till no rainfall is depicted in summer.

During autumn, late October and November are characterized by strong sprinkling rain fall which may lead to torrents in water sliding area. The average maximum temperature in summer is 33 ^oC, in winter is 20 ^oC and in spring is 26 ^oC the average minimum temperature in summer is 18 ^oC, in winter is 7 ^oC and in spring is 13 ^oC. The temperatures in autumn are almost equivalent to the temperatures during spring.

The hot Khamasein wind waves may increase the temperature to above 40 ºc. The relative humidity is 30% in summer, spring and autumn and is 40 % in winter. The daily average relative humidity on the northern coast is 70% along the year and decreases gradually inside till it reaches 40% in desert at latitude 30 north. The wind is changeable during winter and spring. In winter, the wind blows in the southern direction. The southern wind is characterized by ranging from moderate to light wind whose speed reaches 50 km/hr. once or twice a month. In spring, the wind direction is from the north and northeastern and also the southwestern mostly in the morning. In summer, the wind direction is mainly north and northwestern.

The climate data indicates that the annual rainfall in the study area varies between 35 and 50 mm/year. Despite its limited quantity, it is considered as the main source of recharge to the shallow aquifers (sand dunes and wadi deposits). Nevertheless, the limited recharge rate to the shallow aquifer is not sufficient for any sustainable development in the area.

Table 5-2 Mean monthly values of the meteorological parameters in north Sinai

Month	Air Temperature		Relative Humidity	Wind Speed	Rainfall (mm)	Evaporation rate
	Mean (max)	Mean (min)	%	(knots)	(mm)	(mm/day)
Jan	19.2	8.5	70	4.7	20.3	1.9
Feb	19.9	9.1	69	5.5	17.1	2.4
Mar	21.3	18.8	67	5.7	12	3.2
Apr	23.7	13.3	67	4.8	6.1	3.8
May	26.9	16.1	68	4.6	3.2	4.7
Jun	28.9	18.9	72	4.5	0	5.5
Jul	30.6	21.3	74	4.3	0	5.5
Aug	31.1	21.9	75	4	0.2	5.2
Sep	29.9	20.4	71	4.1	0.6	4.4
Oct	28.5	18	73	3.5	6	3.2
Nov	25.3	14.4	71	3.9	16.2	2.5
Dec	21.4	10.2	66	4.6	22.2	2.2

Source: Environmental profile of North Sinai Governorate in 2007

5.2.1.2 Topography

North Sinai is characterized by the dominance of coastal plains of a level that doesn't exceed 50 meters and Al Kebab provincial land of level (200-500 meters). It is noteworthy that the coastal plains extend along the Mediterranean coast over 200 Km from Ismailia to Rafah. These plains are in the form of flat plains intersected by sand dunes, which regained its sand from Nile sediments and during formation of coastal sediments on the coast of Sinai Peninsula.

The western part of these plains is a natural extension of River Nile Delta. Also, Al-Arish valley, located on Nile estuary, is considered to be one of the physiographical landmarks for this region.

The middle region is also known as middle plateau region (total area 20,000 Km2). It is known as plateau region as it includes two huge plateaus of level range 500-1500 meters.

The first one is Al-Teyh plateau that is located in the Northern Province (500-1000 meters height). It oversees the northern parts of Aqaba and Suez Gulfs over steep edges.

The second one is Al-Agama plateau topped with wide plains which pour in the East (Wateer Valley).

The mountains region is located in southern Sinai and is subtended by: Suez Gulf, Aqaba Gulf and southern Agama plateau. It is a steep area that includes a number of mountains of heights exceeding 2000 meters such as: Saint Catherine, Om Shumar, Moussa and Sourial mountains. It is mainly made of rigid igneous rocks.

Concerning river drainages, Sinai Peninsula is composed of five main basins:

- **Al-Arish Valley basin**

It has the highest water potential (about 1100 Km) where it has a lot of natural water springs, which are perfectly utilized such as: Beqa'a and Qadis springs.

- **Gulf of Aqaba valleys' basin**

Its annual drainage rate is about 250 mm, which is makes it hardly classified as a major constituent in agricultural development in Sinai. Moreover, the current situation of its soil is not good enough for agriculture.

- **Garafi valley's basin**

Its drainage rate reaches 80 mm and could be planted with different cops especially in Kentella region.

- **Gulf of Suez valleys' basins**

Its drainage rate is about 3000 mm and has potential soil and water supply that makes it a viable option for agricultural development in North Sinai.

- **North coast basin**

It is considered as one of the major geo morphological landmarks in Sinai Peninsula that has a total area of about 40,000 Km2, representing one third of the total area of Sinai Peninsula. The following table shows the major valleys in North Sinai governorate:

Table 5-3 Major valleys in North Sinai governorate

Valley	Total area in m^2	Total area inside North Sinai governorate m^2	Rainfall m^3	Area % in accordance with total governorate's area
Al-Arish	19500	14500	1100	52.6
Al- Garafi	3037	2446	95	8.8
North coast	11449	11449	921	41.5

Source: Environmental profile of North Sinai Governorate in 2007

5.2.1.3 Geology of the Sinai Peninsula

The main geological characteristics of Sinai Peninsula can be differentiated from the older to younger units as follows:

- **Pre – Cambrian era:**

This era is represented in Sinai by basement rocks, that forms the southern triangular Peninsula of total area 7500 Km and other basements rocks of types: Gneiss, Igneous rock and metamorphic rocks, which exist in (Feran valley, Al-Kayed valley, Saint Catherine and dams)

- **Palezoic era:**

This era includes:

a) Pre-Carboniferous Sediments

This section is represented by a series of sediments, which extend from Cambrian era to Devonian era, and of total thickness 500 meters. These sediments are found in: the eastern side of Sinai right by the western shore of Aqaba Gulf, regions in western and middle of Sinai and in Feran valley. These sediments are composed of:

1. Araba formation

It is found in different thicknesses according to its location as follows:

- 20-40 meter in Saint Catherine
- 45 meter in Om Bagama
- 100 meter in Feran valley
- 100-148 meters of clay soil and sandstone in the east

2. Naqus formation

It covers vast areas on the edges of basic rocks extending from southern to middle Sinai. Their thickness exceeds 250 meters in the southern parts and decreases to 20-30 meters in the north and in Om Bagama.

b) Carboniferous Sediments

These sediments appear in the western side of Sinai between Araba Mountain and Agama plateau and extends to Abou Zaniema. The thickness of such sediment fluctuates over

different location, as it exceeds 350 meters in the north while it hardly reaches 80 meters in the south.

c) Permian Sediments

The sediments of this era is found in the middle and south of Sinai in the form of Qissib Fm.

- **Mesozoic era:**

Mesozoic era is composed of the following sediments:

a) Triassic Sediments

The sediments of this era is found in one place in Sinai which is the core of Areif en Naqa Mountain and is divided into three sections from the lower to upper levels:

- Section (A) of thickness 50 meter which is composed of coastal sediments that are found on two subsections:
  - Lower subsection of thickness 230,000 meters and is composed of sandstones that has no fossils.
  - Upper subsection of thickness 180,000 and is composed of sandstone, limestone and clay soil.
- Section (B) of thickness 18 meters composed of sandstones, clay soil and traces of Dolomite.
- Section (C) of thickness 117 meters composed of clay soil, limestone, Marl stone and traces of Dolomite

b) Jurassic Sediments

They appear in Northern Sinai specifically in the following locations: Al-Gadi, Al-Mnshareh (80 meters) and Areif en Naqa (141 meters). They were also found during the search of Petroleum wells in places like: Al-Khubra 1, Al-Gabal Al-Halal 1, Al-Nekhel 1, Al-Ahmar and Salaf 2. In the following section the Jurrasic sediments are categorized from older to younger units as follows:

- Lower Jurassic of thickness 663 meters and is composed of:
  1. MashadaFm (100 meters) made of sandstones with clay and limestone
  2. RajabiaFm (292 meters) made of limestone with clay and traces of sandstone.
  3. ShushaFm (271 meters) made of sandstone and traces of limestone.
- Middle Jurassic of thickness 675 meters and is composed of:
  1. BirMaghara (442 meters) and this formation is divided into three members:
     - Mahl member (93 meters): limestone and clay soil.

- Moweirib member (133 meters): clay mixed with limestone and sandstone.
- BirMaghara member (216 meters): clay, limestone and sandstone.

2. Safa formation (215 meters)
   - Lower section (100 meters) and is composed of sandstone, clay soil and limestone.
   - Upper section is composed of limestone mixed with clay and is lined with a layer of limestone (30 meters).

- Upper Jurassic of thickness 575 meters that is made of Masajid Fm. This formation is divided into two members:
  1. Kehailia member (132 meters): limestone mixed with clay and sandstone.
  2. Arousiah member (443 meters) made of limestone.

c) Cretaceous sediments

The rocks of this era is dominant in middle and northern Sinai. The lower Cretaceous covers the limestone of the upper Cretaceous in a case of incompatibility. The sediments of this ears are thoroughly discussed in the following section:

1. <u>Lower Cretaceous</u>

The sediments of lower Cretaceous is also known as salt formation (except in Rissan Anizah area) and their thickness reaches 17-130 meters of sandstone and slate stone. These sediments are formed in different regions as follows:

- In Areif en Naqa the sediment is composed of sandstone (grey and while quartz) with some interventions of slate layer. The salt formation in this area settles on 5 meters of Conglomerates and basalt of 15 meters' thickness permeates the lower part of the formation.
- In Bir Al-lagma the formation is made of limestone and sandstone of thickness 110 meters.
- In Yaleq Mountain it appears in the form of 5-15 meters of Conglomerates and 160-168 meters of sandstone.
- In Gabal Al-Halal Mountain, the formation appears in the form of 468 meters of sandstone and traces of slate as well as clay.

2. <u>Upper Cretaceous</u> is composed of:

a. *Cenomanian*: Cover vast regions in North and middle Sinai (Gabal Al-Halal Mountain, Yaleq Mountain, Lobna and Al-Gadi), moreover, its sediments cover the

salt formation in a compatible manner. The Cenomanian layer's thickness reaches 450 meters in the form of limestone and marl dolomite in Gabal Al-Halal Mountain. It also elevates Areif en Naqa Mountain with thickness of 310 meters.

b. *Touronian:* Its sediments spread over Cenomanian in a considerable compatibility with thickness of 50-280 meters. In Areif en Naqa the Touronian's thickness reaches 281 meters. The Touronian sediments are represented in Feran valley with thickness 102 meters composed of: limestone and dolomite with Marl and clay.
c. *Senonian:* The Senonian sediments is dominated by coastal characteristics and is covered with Touronian formation. This era is composed of:

i. MatullaFm

It is composed of sandstone topped with sandstone clay, Marl and clay soil consecutively. The thickness of this formation varies according to locations as follows: In Al Monshareh Mountain it reaches 148 meters and in Feran Valley is ranges from 166-185 meters.

ii. SudrFm

It is mainly composed of chalk limestone and is located in Feran valley, which has number of cracks filled with Calcite, as well as in Agama Plateau with thickness 105 meters.

- **Cenozoic era:**

a) Paleocene Sediments

The section of this formation is known as Esna formation. It is composed of clay, which might contain chalk rocks, and is found in the form of dark rocky units with the following thicknesses:

- 35 meters in Agama Mountain
- 50 meters in Areif en Naqa
- 65 meters in Monshareh
- 40 meters in Feran valley

b) Eocene Sediments are divided from older to younger and follows**:**

a. Middle Eocene of thicknesses 98 meters, which are made of clay mixed with Marl and limestone.
b. Upper Eocene of thickness 68 meters and is composed of limestone, clay, coastal sediments and Marl.

c) Oligocene Sediments

There is no indication for these sediments in Sinai and it was only found in far northern regions and coastal areas in Sinai.

d) Miocene Sediments are made up of two groups:

a. Gharandal group contains different formations:
    i. Nekhel formation of thickness 60 meters in south and composed of sandstones, limestone and clay soil.
    ii. Rodis formation of large thickness and composed of: clay and limestone.
b. RasMalaab group

It appears in RasMalaab group on the eastern shore of Suez Gulf and the thickness of its Gypsum sediment is 450 meters that contains interventions of: clay, Marl, limestone and sandstone.

5.2.1.4 Hydrology

Water is available in North Sinai governorate from the following three sources:

- **Rainfall and Torrential Flows**

The amounts of rainfall over the governorate vary due to the diversity of topography as well as the location from seashore. Rainfall is dominant in winter; at rates ranging from 50 mm in the west and south, and increases on moving to north and east to reach its maximum rate of 300 mm over the Rafah city. This water may be utilized in irrigation and providing potable water after being stored in reservoirs, or may be used directly in irrigation of cultivated lands. The total amount of reaped rainfall waters reaches 14 million cubic meters annually.

- **Well Water**

The study area is located close to the Mediterranean Sea; hence it is expected that the groundwater levels will coincide with the mean sea level or slightly higher. This assumption id due to the hydraulic interaction between the Quaternary aquifer and the sea. Moreover, the limited recharge to the aquifer and the utilization of the stored freshwater in the aquifer would lead to lowering the freshwater levels. In coastal aquifers, the groundwater flow direction is generally towards the sea. Yet, the lowlands act as discharge areas where groundwater tends to flow out in these depressions forming what is called sabkhas.

It has been reported that the groundwater levels vary between less than 2 and 6 meters above mean sea level. However, in some areas (Beer Al Abd) and due to the over-pumping from the

drilled wells, the groundwater levels decline below the mean sea level. In the study area, the depth to groundwater level is expected to be in the range of ± 7.0 meters.

Surface wells are excavated in the northern sand dunes areas located on the east of

Al Arish, In Al-Arish valley, the wells are being excavated on the groundwater reservoirs whose depth in AL Arish valley is 60 meters, and in southern areas may reach up to1, 800 meters according to the geological formation and the sequence water carrying levels. This water is mainly used for irrigation of cultivated lands and domestic/household usage.

Water in Al Arish valley suffer from highly increasing salinity, low productivity, and reduced waster static level in reservoirs, the matter which increases the probability of reservoir-seawater mix especially in the northern areas of Al-Arish.

It is noteworthy that Al Arish includes two natural water springs located on the eastern borders of the governorate:

- Ain Al Godayrat Spring (60m3/hour-1,500 ppm)
- Ain Qeddis Spring (1,000m3/hour-1,500 ppm)

These two speings represent a reliable source for potable water and irrigation of cultivated lands. Moreover, water is supplied to the village of Al-Qasima from Ain AL Godayrat spring.

- **Transferred Water**

From Ismailia Canal

Water is pumped from Al-Ismailia Canal to the treatment plant in Qantara Sharq, where water is filtered and then re-pumped to governorate urban cities including Al Arish City.

It is expected that the fresh water supply service will highly improve in AL-Arish city, and reaches up to Sheikh Zoaid and Rafah, which constitutes a big step forward in both quality and quantity of water. However, the extended length of water pipelines exposes water supplies to many impacts including most importantly, the transgressions made along the pipelines as well as the recurrence of explosions or accidents resulting from the usage of heavy equipment along the route of these pipelines.

5.2.1.5 Ambient Noise& Air Quality

Data about the ambient air quality and noise of El-Roda area is essentially obtained from site visit. It was observed that there is no trace of, factories or any establishments that could be a considerable source of noise or air emissions, except for a few residential houses that are near

from the project location. Accordingly, it is expected that establishing the proposed project won't have a considerable impact.

Reference to the USAID requirements, the consultant has conducted the environmental measurements baseline at the site, where the Air quality (So_x, NO_x, CO, TSP, PM_{10}), and Noise were measured at Two points at the site. The selection of the active air measurement location has based on the prevailing wind direction; site Topography, the future layout of the proposed project components and the location of the nearest sensitive receptors with respect to the site. Moreover, the selection had based on the guidelines stated in the American Society for Testing Materials (ASTM) reference method.

Based on the environmental monitoring and measurements performed for the ambient air quality and Noise, the results showed compliance with all the national and international guidelines. A detailed report of environmental measurements is attached as annex 1.

Kindly refer to the attached annex 1: the detailed ambient air quality and Noise report.

5.2.1.6 Flora

North Sinai Governorate is considered one of the most significant regions of plants that have nutritional, medical benefits. The diverse topography and soil structure allow the significance and distinction of these natural plant areas. As the plants can be classified as follows:

1. Mountain flora; such as thyme which is found in rocky valleys in middle Sinai like Al-Tamad valley.
2. Juniper remnants from coniferous forest which are found in Al-Maghara, Halal and yalg heights.
3. Semi-arid flora; such as achillea, teucrium, Densely plant and Achillea
4. Arid flora such as: Peganum, Anabasis and Juncusacutus
5. Sand dunes flora such as: Lepidium and Cyperus
6. Sandy desert flora such as: Retamaraetam and Artemisia

Due to the great significance of medical plants, 150 medical plants in north Sinai valleys were added to the medical plants encyclopedia which is published by the national association for environment protection.

Due to the great significance of medical plants, 150 medical plants in north Sinai valleys were added to the medical plants encyclopedia which is published by the national association for environment protection.

Figure 5-4 Dominant species of flora in El-Roda

5.2.1.7 Fauna

The wildlife in Sinai has encountered many problems that led to vast drop in the reproduction and immigration rates, among these problems:

- The fact that Sinai has been a war site for consecutive wars, military operations and preparation for such operations. This fact led to deterioration of many wild animals.
- Overfishing acts that has been all around the governorate to hunt animals like: gazelles, wild rabbits and Houbara Bustards specifically starting in December until March, when a number of armed hunters crossed the valleys attacking different species of animals. Therefore, the governorate along with active non-governmental organizations has fought against these acts until Sinai was declared as a closed military region.

- Extreme drought at certain rejoins, which led to the deterioration of vegetation layer and limiting food resources for animals and plants.
- The evolution of wild life animal as well as reptiles' trade without monitoring and inspection processes from the organization in charge.
- The lack of structured programs that aims to monitor the health consitions for these animals.

Therefore, the wild life in Sinai is represented in a very specific and limited number of species as follows:

1. Animals: mouse, wild rabbits, red wolves, sand wolves, Fennec fox, crested porcupine, hedgehog, Dipodidae and caracals.
2. Reptiles: Monitor lizard, Uromastyx, Chameleon, Savigny's agama and Lizards.
3. Birds: hawks, owls, corvus, ruddy ground-dove, hoopoe, partridge and lark.

Figure 5-5 Types of fauna in project area

5.2.1.8 Social Baseline

This Section aims at describing of the approach and methodology to conduct the socio-economic environment of the project areas in details during implementation of the ESIA. Socioeconomic analysis will be conducted through using the spatial and time boundaries of the project.
The study team will depend on their study on clear analysis of the secondary and primary data, observation and picture documentation of all the activities implemented during the data collection process. Depending on a combination of both the primary data collected from the field as well as the secondary resources reviewed including statistical data, in addition to the consultant's previous experiences in the project area, the Social base line in the ESIA will highlight the following:

1- Generic information about the project areas
2- Administrative areas
3- Urbanization trends
4- Demographic characteristics and human development profile
5- Economic profile
6- Access to basic services
7- Health profile
8- Gender dimension
9- Perceptions and predicted impacts

6. Scoping Activities (Stakeholder Consultation and Engagement)

Under the Egyptian environmental law no. 4/ 1994 and its amendment no. 9/2009 modified with ministerial decrees no. 1095/2011 and no. 710/2012, then 964 of 2015 a number of institutional stakeholders (representatives of the Egyptian Environmental Affairs Agency "EEAA" and its regional branches, related governmental authorities, governorate where the project is located, local parliaments and influenced groups of institutions or residents) must be represented in the consultation held prior to the approval for proposed projects that need an Environmental and Social Impact Assessment (ESIA). Other parties may participate such as the NGOs and the universities.

The scoping consultation as an early stakeholder participation has been conducted by a social specialist's team, where they met all the relevant stakeholders either individually or in groups. The research team for this study has adopted consultation activities that enable the stakeholders to gain information about the project. As well, gathering information about their concerns and worries regarding the project during various implementation phases. **Table 6-2** illustrates the outcome of the consultations showing the relevant entities, with the interviewee basic information and their opinion on the proposed project. All activities conducted were documented in order to warrantee appropriate level of transparency, bearing in mind the conservative nature of the existing community.

The difficult nature of the area imposed constrains that influenced consultation activities. Due to the security conditions, and the Corona pandemic, it was relativly difficult to go to the surrounding project areas. Therfore, the consultant went to a consultation stratigy depends on an one to one interview or to some extent focus group discussion. The consultation has been conducted with some of resedints and stakeholders to get the community people expression and their concerns about the project. The main opportunities and challenges points that would be assumed from the interviews could be briefed as following:

a) Opportunities and Strengths

- Generally, the project is highly appreciated and accepted by the community.
- There are some of construction contractors and companies in the city that can carry out all required construction work.
- Availability of workers from the city or from El-Roda village, near the place of the project.
- All the food supplies for workers , and the housing are available around.
- Presence of associations and administrative society that have the ability to communicate with the people and inform them about the project.

- All the employees in the Environmental Affairs Agency and the governorate are cooperating and can facilitate licenses and required logistics.

b) Challenges and weaknesses

- The difficult security conditions afflicting the entire region
- North Sinai Governorate in general, and the project area in particular is under the control and supervision of the Egyptian army, therefore it is necessary to fully coordinate with the military authorities in all the project phases.
- Corona pandemic situation has prevented public hearings or even groups discussion
- All the necessary supplies of building materials used in construction is not available around. It is important to coordinate with the administrative authority and the military authority to facilitate transportation of the required materials to the site.
- Most of public infrastructure doesn't available in the project area, especially water.
- The lack of engineers or professional technicians who specialize in this field in the city.

Targeted Consultations

As part of the scoping process of the Project, targeted consultations were undertaken with key stakeholders that are relevant to the Project to include but not limited to: (i) central governmental entities; (ii) local governmental entities; (iii) key Non-Governmental Organizations (NGOs); (iv) local community representatives; (v) and other.

The objective of such consultations was to:

- Introduce project (rationale, objective, location, key components, etc.)
- Explain and discuss overall methodology for ESIA study
- Explain and discuss key anticipated impacts as relevant
- Identify and determine additional requirements or key issues of concern to be taken into account for the ESIA study

Table 6-1 represents the main stakeholders identified for the consultation activities and the role of each in the proposed project:

Table 6-1 Main stakeholders identified for the ESIA

Stakeholder	Role/ concern
1. North Sinai Governorate	The main role of the governorates is the provision of support to the project through providing various permissions needed. In addition, they will be responsible for managing the fish farm project.
2. Water and Wastewater Companies	
WWHC Headquarter	Responsible for designing and monitoring activities
North and South Sinai Water and Wastewater company	They will be the main entity responsible for the implementation, monitoring and operation of the Desalination plant, as well as, disbursing compensation
3. Other governmental entities	
Local Governmental units Bir Al Abd District.	Permissions for digging and construction activities during the implementation of the project. Permissions for the lands needed.
Information Centers on the governorate level	Provide the project with the underground utilities and infrastructure maps.
Governmental Authorities	Various authorities in the governorate will support the project through permissions, maintenance, health related issues, etc.
Ministry of Health	Providing health facilities to the project workers
Ministry of Water Resources	They are one of the main stakeholders responsible for issuing the permission for wells installation.
Ministry of Tourism	They have no concerns related to the project
Ministry of Antiquities	They have no concerns related to the project
Security Department	Secure the construction sites and prevent people from in- flushing into it
4. Environmental sector	
Egyptian Environmental Affair Agency (HQ and RBOs)	Responsible for reviewing and approving ESIAs, and monitoring implementation of the Environmental Management Plan

Stakeholder	Role/ concern
Environmental entities within the governorate	They are responsible of monitoring the project impacts during the operation phase
5. Media	
Websites editors	Inform the community about the project and its impacts and support dissemination of ESIA studies' results
6. NGOs and community-based societies working on environmental and social related aspects	
NGOs on the central level	Play an active role in various awareness-raising related to the project 1- Information about the impact of the plant 2- How to avoid the adverse impacts?
NGOs on district level	
7. Educational institutes	
Secondary vocational schools	Propose needed capacity building for their students to potentially find employment with the project
Researchers/consultants	Review results of the study and provide feedback
8. Community people	
Community leaders	They have no concerns related to the project
Potential beneficiaries	Potentially benefit from the project
Residents of El-Roda	They are the main project affected category

As mentioned above, due to the security conditions, and the Corona pandemic, it was relatively difficult to meet all the stakeholder. The social team had met the most relevant stakeholders and got their outcome. The table below presents summary for the outcomes of the stakeholder consultations undertaken, while the figure that follows presents sample photos.

Table 6-2 : Summary of consultation activities and stakeholder inquiries and feedback in

Entity	Representative	Key Outcome
Central Governmental Entities		
EEAA, Env. Representative- Suez Branch	**Dr.** [redacted] General Manager of the EEAA Regional Branch -Suez Branch [redacted]	- Stated his support for such project as such developments are considered environmentally friendly developments that produce another source of fresh water supply that would serve the needs of the residence at present and in the near future. - The area of the project doesn't have any environmental concerns or precautions that might prevent the project establishment.
Water and wastewater Holding Company	**Eng.** [redacted] Projects manager of the North Sinai Water Company, [redacted]	- Stated that water requirements for the resident community consider a high priority requirement so such kind of project will be a key for sustainable development for now and future in addition to the direct and indirect job opportunities. - Support people to resettle in the area that was abandoned due to scarcity of water supply - Secure water to the community will reduce the cost of purchasing water - Also, as a direct effect of the desalination project, the local inhabitants in Bedouin communities will not resort to using well-water of relatively high salinity for drinking or cooking. The freshwater made available by the desalination plant shall provide a healthier alternative for these communities that will elevate the overall health condition of these inhabitants. - The aquaculture project is expected to create new job opportunities for the local inhabitants. Furthermore, these individuals will gain experience in a new technology of aquaculture in addition to direct profit shares that will contribute to some of them having start-up businesses in that field and creating further opportunities of entrepreneurship.

		- The aquaculture project is expected to produce fish independent of the regular fishing seasons. This continuous supply will help reduce the price of fish in the local market and hence increase the well-being of the North Sinai inhabitants - Some people might use the produced water for irrigation purposed which might be a waste of resources.
Local Governmental Entities		
Governorate of North Sinai	[redacted] General Assistant Secretary of the governorate	- Stressed on the positive impacts of the Project in providing fresh water for all the communities around the project area - The fishes farm will be owned by the government and jointly managed by the government and communal entities formed by the local population while the revenues will be directed towards the welfare of the local population. On the other hand, the salt production ponds will be leased to an investor through bidding procedures while the leasing revenues will be directed towards the welfare of the local population. - Additionally, such activities expected to create new direct job opportunities for the local inhabitants in addition to new jobs within the desalination plant and new job opportunities in the salt industry.
Presidency of the centre and the city of Bir al-Abed - North Sinai	[redacted] Bir Alabd City Vice President	- Stated the important of the project as it consider one of the major initiatives adopted to withstand the critical potable water supply shortage in North Sinai Governorate. - Stated the goal of the project as it assists economically depressed urban and rural communities to realize more employment, greater economic development, and better living conditions through improved environmental services. - The project will achieve sustainable development to the project area and the population in concern.

		- The project is targeting to create job opportunities for youth and economic development for the residents of El-Roda village. The youth group has 21 members (19 males and 2 females).
	Eng. [redacted] Environmental Ofice manager of Bir Alabd Centre, [redacted]	- Stated his support for the project and mention all the positive benefits will be obtained from the project as: - i) renewable source of fresh water; ii) sufficient production from associated fish farms; iii) salt associated industries; iv) Providing job opportunities for citizens especially youth group.
	[redacted] Chief of EL-RODA Village [redacted]	- Stated his support to the project and mentioned many existing facilities that cooperate to achieve the optimum benefit from the project as: i) the location of the desalination plant will be near to the village water storage tanks which already Equipped with Water distribution network and sewage network ; ii)The project location suitable for construct a salt ponds for the disposed salt; iii) the municipal waste from the project can be safely and easily disposed in EL-RODA wastes disposal station which is 2KM from the project location . - The project will provide job opportunities for young people during the construction period. - The associated aquacultures farms will Contribute in increasing the fish production capacity. - the project aims at bridging the gap of water supply and Provides a permanent source of water. - The desalination plant, associated fish farms and associated salt production industries all will realize more employment, greater economic development. - the fish farm will be owned by the government and jointly managed by the government and communal entities formed by the local population while the revenues will be directed towards the welfare of the local population. On the

		other hand, the salt production ponds will be leased to an investor through bidding procedures while the leasing revenues will be directed towards the welfare of the local population. - The income from the fish farms will contribute to serve and develop the village. - His only concern was that the project funded by internationals agency used to be disqualified and mismanagement after implementation, and he recommend that USAID should be responsible for managing the desalination plant for one year from the startup. - Also, he mentions asuggestion for improve the quality of media in the aquaculture farms is to supply the farm with fresh water from the desalination station.
Environmental Representative in North Sinai Governorate	[redacted] Manager of Environmental Affairs Agency, El-Arish branch. [redacted]	- They have no concerns related to the plant. - In general, they stated that such renewable fresh water resource projects have significant positive impacts on the near and long-term levels.
	[redacted] Environmental inspector in the Environmental Affairs Agency. [redacted]	- Stated that the Project will have key positive impacts on local communities through providing job opportunities, local subcontracting works as well as service provisions for workers (such as housing requirements).
	[redacted].	- Expressed their willingness to participate in any work that could be required for the project.

	Administrative and financial at the Environmental Affairs Agency [redacted]	
	[redacted] Environmental management representative [redacted]	- he has no concerns related to the plant and mention the positive goals from the project as the following: - - Develop renewable sources of water rather than aquifer that might be consumed totally - Reduce the dependency of filtrated water from El Qantara - Water will encourage people to resettle in the area. - Water quantity will be enhanced. - The aquaculture project is expected to create new job opportunities for at least 21 of the - local inhabitants. Furthermore, these individuals will gain experience in a new technology of aquaculture in addition to direct profit shares that will contribute to some of them having start-up businesses in that field and creating further opportunities of entrepreneurship. - The aquaculture project is expected to produce about 33 tons/year of grade 2 and 3 fish that will take part in making-up for the reduction of production in North Sinai in the past years. This increase in fish supply will help reduce the price of fish in the local market and hence increase the well-being of the North Sinai inhabitants. - The aquaculture project production will help in reducing the price of fish in the local market and hence increase the well-being of the North Sinai inhabitants.

Local Community / Residents		
El-Roda residents	[redacted] Technition in El bardawel lake [redacted]	- Stated his support for the project and mention all the benefits will be obtained from the project. - Will provide water supply to the community - Develop renewable sources of water and reduce reliance upon Nile water - Will help people to resettle in the area
	[redacted]	- They have no concerns related to the plant. - Stated that the Project will have a positive impact on local communities through providing job opportunities, local subcontracting works as well as service provisions for workers (such as housing requirements). - They are interested about the direct effect of the desalination project, the local inhabitants in beduoin communities will not resort to using well-water of relatively high salinity for drinking or cooking. - They stated that the freshwater made available by the desalination plant shall provide a healthier alternative for these communities that will elevate the overall health condition of these inhabitants.
	[redacted] Heath inspector [redacted]. [redacted] [redacted].	- They have no concerns related to the plant. - Stated their support to the project.


Local Governorate Representative



Community Representative

Figure 6-1 Selected Photos of Targeted Consultations

7. Environmental Impact Assessment

Given the fact the completion of the site visit and field survey, and completion of the environmental measurement of the baseline, in addition to the availability of the feasibility study, the environmental consultant and the project manager agreed to include the detailed environmental impact assessment and the mitigation measures required in the Scoping Statement Report. The following section describe in details the approach and methodology of the impact assessment and details of project impact on each environmental aspect, then the list of mitigation measured required for the significant impacts.

This chapter provides a comprehensive description of the potential environmental impacts during both construction and operational phases. Potential positive and negative environmental impacts during construction and operational phases are described and the significance of the impacts is assessed. The assessment of the impacts includes whether the identified impacts are short-term or long-term, reversible or irreversible

7.1 Methodology

At an early stage, baseline studies have been carried out to obtain comprehensive information on the characteristics of the existing environment of the proposed project area in ELRoda village. The identified potential environmental impacts on the physical environment are then evaluated against baseline conditions at the proposed location, and the reasonable performance standards which are assumed to be set during the construction and operational phases of the project. Both positive and negative potential impacts on environment during project construction and operational phases will be presented in this section.

Criteria for Assessment of Impacts Significance. In order to precisely identify the overall impact significance, the following factors were determined for each impact.

- Nature of the impacts (i.e. direct, indirect, secondary, cumulative, short, medium and long-term, permanent and temporary, positive and negative)
- Impact severity (positive or negative)
- Extent of the impact (geographical area, size of the affected (population/ habitat/ species)
- Magnitude and complexity of the impact
- Probability of the impact
- Duration, frequency and reversibility of the impact

- Mitigation incorporated into the project design to reduce, avoid or offset significant adverse impacts
- Sensitivity of receptor

All specialists determined the consequence of each factors in a rating system, in order to determine the overall significance of each impact in a uniform format that facilitates understanding of the impact. The rating system was developed by the consultant and encompasses of inputs and rating scale. The rating scale uses

mathematical calculations in order to assign a total value for each impact.

Table 7-1 shows a sample of the inputs of the rating system. Specialists scaled the overall of each impact by assigning a number form a range (-3 to 3) according to the scaling rate. and based on the aforementioned factors using the developed rating system.

Table 7-1 Rating System

Aspects / Criteria	Fauna & Flora	Air quality	Soil and Ground water	Noise	etc.
Direct / Indirect					
Long-Term/ Short-Term					
Reversible /Irreversible					
Regional/Local					
Probability of Occurrence					
Severity					
Accumulative					

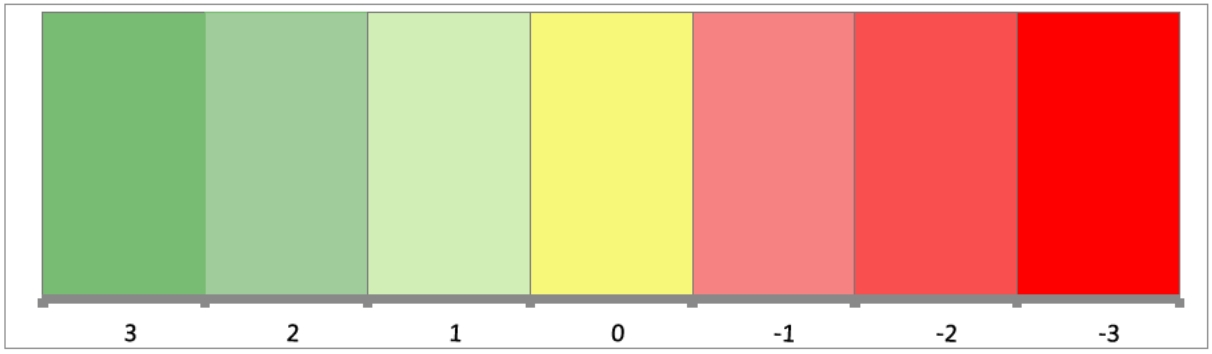


Figure 7-1 Scaling Rate

7.2 Environmental Impact During Construction Phase

It is anticipated that construction of the proposed project will immediately commence after obtaining environmental approval and construction permits. Construction of the proposed project will include normal construction activities that are temporary concerning environmental conditions. These activities include:

- Using Heavy Equipment
- Excavation Works and Leveling
- Using Construction Materials
- Using Human Labor

The following subsection presents a comprehensive description for the environmental impacts of each foreseeable activity during the construction phase.

7.2.1 Using Heavy Equipment

Heavy Equipment is operated by trained operators and is used to perform tasks such as excavating, earth moving, paving, etc. Using Heavy equipment including using machines such as scrapers, dozers, heavy haul trucks, backhoes, graders, loaders, etc. Diesel is the main fuel for most of the heavy equipment that are used for heavy equipment.

Heavy equipment is sources of pollutants that may negatively influence the air quality, since the exhaust from that equipment will also result in release of the exhaust gases such as nitrogen oxides (NO_X), sulfur dioxide (SO_2) and carbon monoxide (CO) to the ambient atmosphere. In addition, heavy equipment is major sources of high noise levels. Besides, movement of the equipment on unpaved surfaces will result in generation of fugitive dust "mainly PM_{10}"; however, movement of heavy equipment is not regularly. Consequently, negative impacts will only remain during construction phase on local extent. Environmental impacts from using heavy equipment are as follows:

- **Impact on flora and fauna:**

According to the conducted surveys at the project area, there are no threatened or endangered biodiversity species that are known to exist within the project area.

Therefore, the impact of using heavy equipment on flora and fauna is considered **NEUTRAL** or equal to Zero.

- **Impact on Air quality:**

The impact of using heavy equipment on air quality is expected from the exhausting of the engines, and the dust fugitive from the movement of the equipment on the unpaved

routs. The expected impacts are mostly temporary, within the scope of the project, and reversible. However, the impact is direct on the workers at the site. The impact is considered **Weak Negative**, or equal to (-1).

- **Impact on soil (solid waste):**

Impact of using heavy equipment on soil might be from unsafe / unproper handling and storage of hydrocarbon compound also can be from spill or leakage during unproper maintenance activities.

Impact of using heavy equipment on soil is rare, local, and reversible. The impact is considered **Weak Negative**, or equal to (-1).

- **Impact on Groundwater:**

Groundwater contamination is not expected since groundwater basin is located at more than - 60 m depth. Impact of using heavy equipment on groundwater does not apply. Consequentially is considered **NEUTRAL** or equal to Zero.

- **Noise:**

The most vulnerable receptors to noise pollution are the workers who will be exposed to high levels of noise level during construction phase. However, the exposure is direct, temporary and reversible. Consequently, the impact of using heavy equipment on the closest receptors is considered **Weak Negative**, or equal to (-1), and on construction workers is **Medium Negative** (-2).

- **Socio-Economic Impact**

From an economic point of view, the use of equipment and heavy trucks represents a beneficial economic factor that leads to economic enhancement to some contractors and labors, but it can also lead to a reduction in the number of manpower. The impact is direct, and high probable, but is reversable and local. Therefore, the impact of this activity on the economic and social side is **moderately positive**. (+2).

- **Traffic**

The construction phase will include transportation of construction equipment and materials. Transportation will mainly be carried out by using existing roads. Therefore, an increase in local traffic to some extent is expected but with no considerable impact.

7.2.2 Excavation Works

Earthworks include excavation, landscaping, backfilling, moving of quantities of topsoil and leveling. Heavy equipment is usually used due to the amounts of material to be moved. Earthworks result in huge amount of soil that may negatively influence the environmental conditions, if not properly managed.

The major sources of potential impacts on air quality during the construction phase of the Project are the generation of dust from earthworks. Dust particles (PM_{10}, and $PM_{2.5}$) rising from earthworks including drilling and vehicle movement could be significant particularly during dry weather conditions, and may cause problems to nearby areas, in addition to creating unsafe working environment during construction phase on local extent. In addition, earthworks will result in destroying biological flora and fauna in the project area. Environmental impacts from using heavy equipment are as follows:

- **Impact on flora and fauna:**

North Sinai Governorate is considered one of the most significant regions of plants that have nutritional, medical benefits. However, given the desert nature of soil in the project area, it is noted that only few palm trees are available and some desert wild plants might be used for grazing. The project area is not defined as habitats for threatened or endangered biodiversity species. Accordingly, the impact of earthworks on flora and fauna is considered **Weak Negative**, or equal to (-1).

- **Impact on air quality:**

Earthworks will negatively influence the air quality in terms of increasing PM_{10} and $PM_{2.5}$ at the project area, but the impact is reversible, and will only remain during construction phase. Consequently, the impact of earthworks on air quality is considered **Medium Negative**, or equal to (-1).

- **Impact on soil (solid waste):**

High amount of excavation waste due to leveling will result from earthworks, consequently, the impact earthworks on soil receptors is considered **Medium Negative**, or equal to (-2).

- **Impact on Groundwater:**

There will be no Impact from earthworks on groundwater, since groundwater table is located Groundwater is located at more than -60m depth, thus the impact is considered **Neutral** or equal to Zero.

- **Noise:**

During earthworks, heavy equipment is the main source of noise. The area is open which reflect to noise dispersion. The noise probability is rare, non-contentious, and low exposure time. Consequently, the impact of earthworks is considered **Neutral** or equal to Zero.

- **Socio-Economic Impact**

Not applied (Zero)

7.2.3 Using Construction Materials

Construction materials includes, using cement, wood, sand, concrete, cables, water etc. All of those materials are used for construction process which in turn generates a considerable amounts of construction waste such as cables, empty containers of various size, steel etc. construction waste usually removed on a regular basis from the construction site, since remaining of construction "construction waste" can negatively influence the environment, in addition to the negative visual impact. Besides, handling some construction materials may result in generation of dust "mainly PM_{10}". Environmental impacts from using construction materials are as follows:

- **Impact on flora and fauna:**

The impact from using construction materials on flora and fauna is negligible and considered **Neutral** or equal to Zero.

- **Impact on air quality:**

Only handling of some construction materials, such as loading or unloading cement or sand, will negatively influence the air quality of the working environment only due to dust emissions. However, handling of construction materials will be only during handling of the materials, the impact of construction materials on air quality is considered **Weak Negative**, or equal to (-1).

- **Impact on soil (solid waste):**

Dumping of construction wastes in an uncontrolled site will result in soil contamination and may cause negative visual impact. Therefore, the impact of using construction materials is considered **Weak Negative**, or equal to (-1).

- **Impact on groundwater:**

Water is used as resource during construction activities. Consumption of water during construction is due to construction activities, dust suppression and cleaning. The significant portion of water is consumed during different activities, and the residual is evaporated to the atmosphere. Consequently, the impact of using construction materials on groundwater is considered **Neutral** or equal to Zero.

- **Noise:**

The impact of using construction materials is not applied, and considered **Neutral** or equal to Zero.

- **Socio-Economic Impact**

In the case of using locally-made construction materials, this will have a positive result on the national economy and thus on the social dimension, but it has a limited impact on the project area. Therefore, the impact on the (socio-economic) aspect is weak positive (+1).

7.2.4 Using Human Labor

The project will deal with contractors from the area of the project, and most of the workers from the areas close to the project, therefore there is no accommodation for workers on the site.

- **Impact on Flora and Fauna:**

Not applied

- **Impact on Air quality:**

Not applied

- **Impact on soil (solid waste):**

Not applied

- **Impact on Groundwater:**

Not applied

- **Noise:**

Not applied

- **Socio-Economic Impact**

The impact on the (socio-economic) aspect will be a high positive impact (+3), especially if labors are used from neighboring areas and cities close to the project, particularly from El-Roda village.

7.3 Environmental Impact During Operation Phase

This section will discuss the impact of the project component as mentioned before. The project components are:

- Desalination plant
- Fish farm
- Salt Pond

7.3.1 Environmental Impact Desalination Plant During Operation Phase: -

The operation phase of the project includes the operation of water desalination plant starting from the intake and purification and desalination units, then discharge line to salts pond:

- **Impact on the Fauna and Flora:**

- Not applied and without impact (zero).

- **Impact on air quality:**

The desalination plant does not produce any emissions that affect the air quality. i.e. it has no impact on the air (zero).

- **Impact on the soil:**

Solid wastes resulting from water desalination plant are as follows:

- Empty of chemical packages used in the backwash process of the plant, which is hazardous waste
- Remnants of sand from filters that are changed every long period and they are inert have no effect
- Remnants of carbon filters used in water purification

Even though this waste contains some risk, but it is limited, confined and produced at long frequent up to several months, so the impact on the soil and the surrounding environment is negative average (-2).

- **Impact on groundwater:**

Given the geological nature of the project area, which is characterized by a marsh area, it does not accept the disposal of waste water by injection, therefore, it is planned to direct the discharge of the high saline water (rejected water) to the associated salt ponds after performing appropriate mitigation. The salt ponds are already in operation and have a salty layer that prevent the permeability to the ground water. Therefore, operation of the desalination plant shall have no impact on groundwater. (Zero)

- **Noise:**

Operation of the plant is expected to produces low level of noise that does not exceed 50 - 60 dB and its impact is limited and does not affect the surrounding environment. Therefore, the plant is considered without effect regarding noise (zero).

- **Economic and Social impacts**

- Economically and socially the desalination plant has many positive impacts because it provides large amounts of water without relying on state resources from the public network.
- It also provides job opportunities to a number of workers, whether direct or indirect labor.
- The social impact is not only affecting the community of El-Roda village, but also all Bir el-Abd city. The available job opportunity might be not large, but it will provide many indirect job opportunities. Therefore, the social and economic impact is going to be a medium positive (+2).

7.3.2 Environmental impacts of fish farms during operation.

The operation phase of the project includes filling the fish ponds / basins without coming water from the desalination units then filling the nursery ponds with the baby fish which is removed after few days to the big ponds to continue the lifecycle, the application of feeding programme and finally removal for sediments(waste/residuals) and the sludge from the basins.

In general, the environmental impacts associated with fish farming systems are few and limited. Serious adverse environmental impacts arise from the untreated drainage of these farms to the water sources surrounding the water banks

- **Impact on the Fauna and Flora:**

Since the project area lacks of any endangers species or even have particular importance, the impact on fauna or flora does not apply.

- Not applied and without impact (zero).

- **Impact on air quality:**

The associated fish farms produce ammonia emission in case of poor management for farm solid waste/sludge disposal that affect the air quality. The probability of this impact is small, local, limited time, but its effect is direct and accumulative, while it is reversible. The assessment of this impact could be weak negative (- 1)

- **Impact on the soil:**

In general, implementation of fish farms will directly reduce the fertility of these lands and reduces their contribution to the production of human food. Solid wastes resulting from associated fish farms are as follows:

- suspended solids that are generated during fish production from pond water effluent which is non-hazardous waste
- Sludge / sediments from the fish ponds and settling/sedimentation bonds (rich in the that can used as a fertilizers or biogas, which is non hazards waste.
- Empty bags / packages from feeding materials , which is non-hazardous waste.
- Even though this waste contains some risk, but it is limited, confined and produced at long frequent up to several months, so the impact on the soil and the surrounding environment is **negative average** (-2).

- **Impact on groundwater:**

The operation of the associated fish farms shall have no impact on groundwater.

As All ponds will be lined with the polyethylene sheet 1500 micron that prevent any leaching to the ground water. In addition, the drainage water of the fish farm will be discharged after treatment to the salt pond to complete the cycle of the project.

In case of mismanagement of the fish farm ponds, the problem will arise from the pollution of the ground water with the chemicals and additives used for aquacultures which might be penetrate to the ground water.

The increase in the amount of organic matter in fish ponds will lead to an increase in the number of aerobic bacteria that use oxygen to break down and oxidizing organic matter. The following is that the amount of dissolved oxygen (DO) in the water decreases, resulting in the stress and death of fish and other aquatic organisms and the penetrate of fish farm water to the ground water system leads to organic degradation.

Although the probability of the impact is very low, the effect might be direct, irreversible. The impact could be assessed as **medium negative** (- 2)

- **Noise:**

Operation of the plant is expected to produces low level of noise that does not exceed 50 - 60 dB and its impact is limited and does not affect the surrounding environment. Therefore, the plant is considered without effect regarding noise (zero).

- **Economic and Social impacts**

The fish farm project will lead to change in the social framework at the surrounding area, and may also lead to disturbance of relation if some residents are working as fishermen, where they will find their production is low comparing with the residents works in the farm.

However, economically and socially the associated fish farms have many positive impacts as the following: -

- Creates direct new job opportunities to more than twenty locals, additional to the benefit from the project revenue to the villagers.
- Another bi-product to be produced by the aquaculture project is the natural organic fertilizer. This natural fertilizer will be highly beneficial for the agricultural activities within the surrounding communities as it will relief the local farmers from using non-ecofriendly chemical fertilizers.

- The aquaculture project is expected to produce about 33 tons/year of grade 2 and 3 fish that will take part in making-up for the reduction of production in North Sinai in the past years. This increase in fish supply will help reduce the price of fish in the local market and hence increase the well-being of the North Sinai inhabitants.
- The aquaculture project is expected to produce fish independent of the regular fishing seasons. This continuous supply will help reduce the price of fish in the local market and hence increase the well-being of the North Sinai inhabitants.
- The aquaculture project is expected to produce about 17 tons/year of grade 1 fish that will be a candidate for export. This will create further opportunities for entrepreneurs to invest in new start-ups that will work on associated industries like packaging and exporting fish.

Therefore, the social and economic impact is going to be a **High positive** (+3).

7.3.3 Environmental impacts of salt production during operation.

Salt production will be performed through existing salt ponds with a 27,0000 m^2 total area of ponds needed for vaporization of the water. This process is mainly dependent on the chemical analysis of the saline water that would determine the amount of saline water that could be sent to the salt ponds for salt production from the desalination plant and that from the fish farm.

The operation phase of the project includes the discharge of brine water from the desalination plant and the fish farms into the neighboring ***existing*** salt ponds

From the description of the process, it is obviously that the salt ponds, in general, do not have any significant impact on the environmental aspects, and the only potential impact is limited to water might be penetrated and contaminated of the groundwater.

Given the fact that, ***the nature of the area is being a marsh area***, which made it form an impermeable thick layer similar to the concrete base paved with salt crystals, and that the ground water is naturally very salty, so the project has negligible impact on the ground water or surrounding environment.

- **Impact on the Fauna and Flora:**

- Not applied and without impact (zero).

- **Impact on air quality:**

- Not applied and without impact (zero).

- **Impact on the soil:**

In case of implementation of new ponds, the probability of reducing the fertility of these lands and reduces their contribution to the production of human food. However, the area of the project seems like marsh and not used for agriculture, and the project will use the existing salt ponds. Therefore, the impact on the soil is not applied and without impact (zero).

- **Impact on groundwater:**

In case of implementation of new ponds, the probability of the rejected water to penetrate into the ground water and contaminate it is valid. However, in the proposed project, the operation of the salt ponds shall have no impact on groundwater due to the formation of impermeable layer from the existing salt precipitation, in addition to the ground water has originally high salinity. The impact is not applicable, (Zero)

- **Noise:**

Operation of the plant is expected to produces low level of noise that does not exceed 40-50 dB and its impact is limited and does not affect the surrounding environment. Therefore, the plant is considered without effect regarding noise (zero).

- **Economic and Social impacts**

Economically and socially using the existing salt ponds have many positive impacts as the following: -

- Creates new job opportunities to the local residents, additional to the benefit from the project revenue to the villagers.
- Establishing projects based on salt production.
- The brine water rejected from the desalination plant is extremely saline which will enrich the productivity of the existing salt ponds.
- This impact is direct, highly probable, long term, and accumulative, but it is reversible

Therefore, the social and economic impact is going to be a High positive (+3).

7.4 Impacts Summary

Expected environmental and social impacts of all the components of the project in construction and operation phases had been discussed. These impacts had been analyzed semi-quantitatively and determination of the degree of impact of each component on each aspect of the environment had been performed. The following table shows a result summary of what assessed in the fifth chapter of environmental impact assessment.

Table 7-2 Environmental Impact Summary

Affecting Activity	Impact degree of on the environmental media					
	Fauna & Flora	Air Quality	Soil Quality	Groundwater	Noise	Economic and Social Environment
Construction Phase						
Using Heavy Equipment	zero	-1	-1	zero	-2	+2
Excavation Works and Leveling	-1	-1	-2	Zero	Zero	Zero
Using Construction Materials	Zero	-1	-1	Zero	Zero	+1
Using Human Labor	Zero	Zero	Zero	Zero	Zero	+3
Operation Phase						
Desalination Plant	Zero	Zero	-2	Zero	Zero	+2
Fish Farms	Zero	-1	-2	-2	Zero	+3
Salt Ponds	Zero	Zero	Zero	Zero	Zero	+3

8. Mitigation Measures

In chapter 5 all the expected environmental and social impacts have been studied and assessed. Although the project with its components has limited negative impacts, the consultant has recommended a list of mitigation measures for each individual impact.

The following tables present the proposed mitigation measures to reduce or minimize any identified negative environmental impact to the possible lowest extent. **Table 8-1** identify environmental impacts, propose mitigation measures and provide the final assessment after implementing the mitigation measures.

Table 8-1 Environmental Impact assessment and proposed mitigation measures

Impact Reference	Impact Description	Proposed Mitigation Measures	Impact Assessment after implementing the proposed Mitigation Measures
CONSTRUCTION PHASE			
Air Quality	Increase Particulate matter (PM_{10}, and $PM_{2.5}$) concentration especially in the work environment due to: • Movement of Equipment and trucks • Handling of raw materials and workers • Excavations and earth work Concrete patching	Implement a construction site management plan including the following measures: • Store construction materials in pre-identified suitable storage areas. • Cover friable materials during storage. • Although the soil at the site is originally wet due to mash properties, it is recommended to wet the unpaved roads on site. The use of water should be restricted to extremely active areas and use of gray water is highly recommended. • Use of available gravels to pave roads to minimizes dust emissions and the use of water for wetting purposes. • Regulation of speed to a suitable speed (30 km/h) for all vehicles and trucks entering the site.	Zero
	Increase of concentration of gases in the ambient air due to: Exhaust from vehicles and trucks engines	• The project site is located in an open area which is helping in any emission dispersion • Implement preventive maintenance program for vehicles and equipment working on site and promptly repair vehicles with visible exhaust fume.	Zero

Impact Reference	Impact Description	Proposed Mitigation Measures	Impact Assessment after implementing the proposed Mitigation Measures
		• Implement a traffic management plan aiming at reducing the number of trips to a minimum • An administrative order, to the trucks and equipment driver to switch the engines off while they completely stop at the site. • Using locally available materials whenever possible thus limiting the travel distance. Reducing the distance and number of trips will result in an overall reduction in gaseous and carbon emissions.	
Groundwater	In case of improper handling of waste water generated from workforce, groundwater and soil might be contaminated	There is no accommodation of the workers at the site. Accordingly, there is no any waste water source at the site.	Zero
Soil and Topography	Change of quality and stability of soil due to earth works. Contamination of soil might be due to construction waste arising from excavation works.	• Elaborate and implement a soil reuse plan for areas with associated limits in slopes and heights • Elaborate and implement a waste management system. Disposal facilities shall be designated and agreed between contractors and owner representatives prior to construction • A housekeeping crew shall be responsible for site general housekeeping • Excavation wastes stockpile is orderly maintained and protected from wind blow • All waste taken off site shall be carried out by a licensed waste contractor and shall be subject to owner representative auditing • Full coordination with the Competent authority to specify the final disposing location of Construction waste and excavated soil in a secured dumping site.	Zero to -1

Impact Reference	Impact Description	Proposed Mitigation Measures	Impact Assessment after implementing the proposed Mitigation Measures
	Contamination of soil might be due to unsafe / improper handling and storage of oil and waste oil (hydrocarbon compound's).	• Store waste in appropriate and regulated containers at designated waste storage areas to prevent leaks to the environment. • Periodic inspection for the equipment's. • Waste oils will be stored on-site (in a covered area) within appropriate containers in a manner that prevents the leakage of oil to soil and into ground water; • Training on how handle and store the hydrocarbon compounds	
Flora and Fauna	The site probably might be the habitats for non-endangered species such as rodents, and Stray dogs.	• Surround the site with a secured fence • Implement a waste management plan and prohibit dumping/uncontrolled disposal of any types of wastes.	Zero
Noise Level	Construction workers are exposed to high noise levels due to construction activities and the operation of heavy equipment and machines	• Ear muffs/protective hearing equipment shall be made available to all workers in noise critical areas • Training on how and when to use protective hearing equipment shall be conducted as part of the workers' induction sessions. • Place visually clear instructions in areas where noise emissions are significant. • Optimize the use of noisy construction equipment and turn off any equipment if not in use. • Regular maintenance of all equipment and vehicles	Zero

Impact Reference	Impact Description	Proposed Mitigation Measures	Impact Assessment after implementing the proposed Mitigation Measures
OPERATIONAL PHASE			
Desalination Fish Farms			
Air Quality	No significant impact	NA	Zero
Flora and Fauna	No significant impact	NA	zero
Groundwater	No significant impact	NA	zero
Soil	Casings of chemical packages (hazardous waste) and remnants of sand from filters, as well as carbon filters	• A Comprehensive Waste management plan shall be implemented to avoid mixing of domestic waste and hazardous waste. The waste management plan will include: • Segregation strategy • Methods of waste handling • Storage precautions • Transportation and final disposal strategy • Roles and responsibilities	zero
Noise Level	low level of noise	No need for ear protection	zero
Associated Fish Farm			
Flora and Fauna	No significant impact	NA	zero
Air Quality	Possibility of ammonia emission	Pond effluent will go also through a sedimentation pond for evaporation of gas waste (ammonia) before discharge to the salt production. Being that the project will implemented in an open area, the dispersion of any emission is expected to be very high.	zero
Groundwater	No significant impact	NA	zero
Soil	Sludge / sediments Empty bags / packages from feeding materials and additives	Solid waste will be restricted by the waste management plan of the project through a contract with certified contractor for collection, transportation, and safe disposal of any solid waste at the site.	zero

Impact Reference	Impact Description	Proposed Mitigation Measures	Impact Assessment after implementing the proposed Mitigation Measures
		The sludge and sediments will be dried and will be disposed through a certified contractor to be used as a fertilizer, since it contains high value of the nutrients.	
Noise Level	No significant impact	NA	zero
Salt ponds			
Flora and Fauna	No significant impact	NA	zero
Air Quality	No significant impact	NA	zero
Groundwater	No significant impact	NA	zero
Soil	No significant impact	NA	zero
Noise Level	No significant impact	NA	zero

Based on the above, and from the environmental and social assessment of the various project activities, whether in the construction or operational phases, the implementation of all proposed mitigation measures and their inclusion in the construction and operation contractors' contracts will lead to the implementation of the project without any negative impact on any of the environmental aspects in the area. Moreover, it will have positive social impacts on the surrounding community in El-Roda village in particular and on North Sinai Governorate in general.

9. Issues to Get Further Consideration During the ESIA Process

The following additional areas of consideration will be taken in more details in the ESIA report.

- The framework chapter will include more details about the administrative, legal, and policy related to the project activities, either the local or international legislation. The legislation chapter will include the following details:
    - Relevant Egyptian Laws and Regulations
    - The Physical and Biological Environment
    - National Legislation Pertinent to the Project
        - Ambient Air Quality and Gaseous Emissions
        - Water pollution
        - Noise Pollution
        - Biodiversity
        - Waste management
        - The socio-cultural environment
    - International treaties
    - USAID Requirements
    - ESIA Process in Egypt
- Social baseline will be described in more details, considering the following:
    - Administrative Areas Distribution
    - Urbanization Trends
    - Basic Demographic Characteristics
        - Population Characteristics
        - Living Conditions
        - Access to Basic Services
        - Human Development Profile
        - Income and expenditure
    - Health Profile
    - Gender Dimension
        - Gender dimension related to Education:
        - Gender dimension related to work and mobility
        - Gender dimension related to water supply
    - Industrial Activities
    - Perception of People Towards the Project

- Analysis of Alternatives: in the ESIA report the consultant will discuss and analyze all the available alternatives. The following structure will be followed:
    - Site Alternatives
    - Water Source Alternatives
        - Sea Water Alternative
        - Wells Water Alternative
    - DRAINAGE ALTERNATIVES OF THE DESALINATION PLANT
        - Discharge to the fish farm basin
        - Discharge to the salt ponds, either new or existing
        - Deep Well Option
        - Sea Option
    - Required utilities: electricity, treatment plant, waste management, … etc.
    - Conclusion
- Environmental and Social Management and monitoring Plan will be created and provided to be used as a standalone document, so that could be used in the ToRs or the contract of the contractors either during the construction or the operation phase.

The ESIA shall follow the guidelines set by USAID for Environmental Assessment.
Broadly the ESIA will contain the following sections:

- Summary of Findings: This section will provide a summary of overall finding of the Environmental Assessment.
- Section 1.0: Introduction - The section provides introductory information including location maps and an explanation of the need for the project.
- Section 2.0: Environmental laws, policy and procedures - This section describes in detail the regulatory requirement for which the project should follow
- Section 3.0: Project Description and alternatives - This Section presents technical details of the proposed Project and alternatives considered.
- Section 4.0: Scoping Statement – a summary of the scoping process including consultation.
- Section 5.0: Affected Environment – a detailed description of the baseline conditions of the project, this should include all of the significant issues identified in the scoping process.
- Section 6.0: Project Environmental Impacts / Affected Environment – a detailed assessment of the potential project related impacts and the proposed mitigation.

This data should also be summarized in a matrix format. Detailed mitigation should be provided to ensure that all impacts are managed appropriately in line with USAID regulations and best practice.

- Section 7.0: Environmental Mitigation and Monitoring Plan – The plan will include mitigation, monitoring, responsibilities, and capacity building requirements.
- Section 8.0: Conclusions and Recommendations – a summary of the findings of the ESIA.

10. Consultation Team

The ESIA will be conducted by a professional local team of environmental experts who shall gather data, from both existing studies and from the field. The following table illustrate the core team of work who participated in this scoping statement report and will conduct the ESIA report. In addition to an integrated team in various experiences including Geology, Hydrology, biology, legal, HSE, social surveyors, environmental monitoring, …. Ect.

In addition, the reports would be revised by the client/USAID representatives, and their comments and guidance would be addressed in the final version.

No.	Name	Title	Task
1	Chem. Fakhry Abdelkhalik	Environmental management expert – team leader	Guidance, Supervision and General revision of the reports. Preparation of the legal framework. Preparation of the ESMP.
2	Dr. Ehsan El-Hady	Ecology, and biodiversity expert	Preparation of the baseline assessment.
3	Dr. Mahmoud Nour El-Dien	Environmental Quality expert	Conducting the environmental measurements at the project area, and assess the Air quality and Noise
4	Chem. Marwa Kosbar	Senior Environmental Specialist	Preparation of the Project Description, Environmental Impact Assessment, and Mitigations measures.
5	Chem. Sara Hamdy Ibrahim	Senior Environmental Specialist	Assist in the preparation of the report
6	Mr. Mohamed Abdelhady	Social Expert	Preparation of Social Impact Assessment and stakeholder consultations

11. Annex 1

The Detailed Ambient Air Quality and Noise Report

Ambient Air Quality and Noise Measurements Report

El-RODA Desalination Plant and

Associated Fish Farm

Green plus Environmental Solutions

PLUS Green
ENVIRONMENTAL SOLUTIONS

August 2020

CONTENTS

1. INTRODUCTION

Air quality and noise monitoring have been carried out as part of the Environmental air and noise quality measurements of El- Roda Desalination Project and associated fish farm at El Roda village, Beir Al Abd District in North Sinai Governorate.

Air quality monitoring has been undertaken for the pollutants of primary concerns (NO_2, SO_2, CO, PM_{10} and $PM_{2.5}$); in order to better characterize the ambient air quality, as part of the environmental measurements required. Where, a one-hour average measurements were conducted for carbon monoxide (CO), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), particulate matter (PM_{10}) and theoretical matter ($PM_{2\,5}$), for Two specific locations, where the air quality complies with the national guidelines for all the analysed parameters. The site-specific air quality measurements had conducted using Standard ambient air quality monitoring instruments under the supervision of experienced specialists. Noise levels had conducted as per the international standard using type 1 precision noise level meter.

1.1 Objectives

The overall objectives of this monitoring round are to:

- Assess/confirm compliance of the air quality in the ambient environment with relevant national guidelines;
- identify any non-compliance issues, if any; and
- Provide general conclusions based on analysis results.

1.2 Scope of Work

- The scope of work of the present monitoring includes the sampling and analysis of active air and noise in the surrounding area as to distinguish whether air quality has influenced by the project activities or not.
- The measurements will be conduct in two locations within the boundaries of the sensitive receptor.

1.2.1 Sampling strategy

The selection of the active air measurement location has based on the prevailing wind direction; site Topography, the future layout of the proposed project components and the location of the nearest sensitive receptors with respect to the site. Moreover, the selection had based on the guidelines stated in the American Society for Testing Materials (ASTM) reference method[1].

The following ambient air pollutants where the target parameters, which will be measure during the monitoring program:

- Theoretical Particulate Matter ($PM_{2.5}$)
- Thoracic Particulate (PM_{10})
- Nitrogen Dioxide NO_2.
- Sulfur Dioxide SO_2.
- Carbon Monoxide CO.

Moreover, location of the measurements has shown in the figure below

[1] D1357-95 (Reapproved2000) Standard Practice for Planning the Sampling of the Ambient Air

1.3 Location

The GPS coordinates of the as Ambient Air (**AA**) measurement location and noise level measurements

Table 1-1 Locations Coordinates

Locations	N	E
AA1	31° 2'26.25"	33°20'25.03"
AA2	31° 2'18.42"	33°20'26.58"

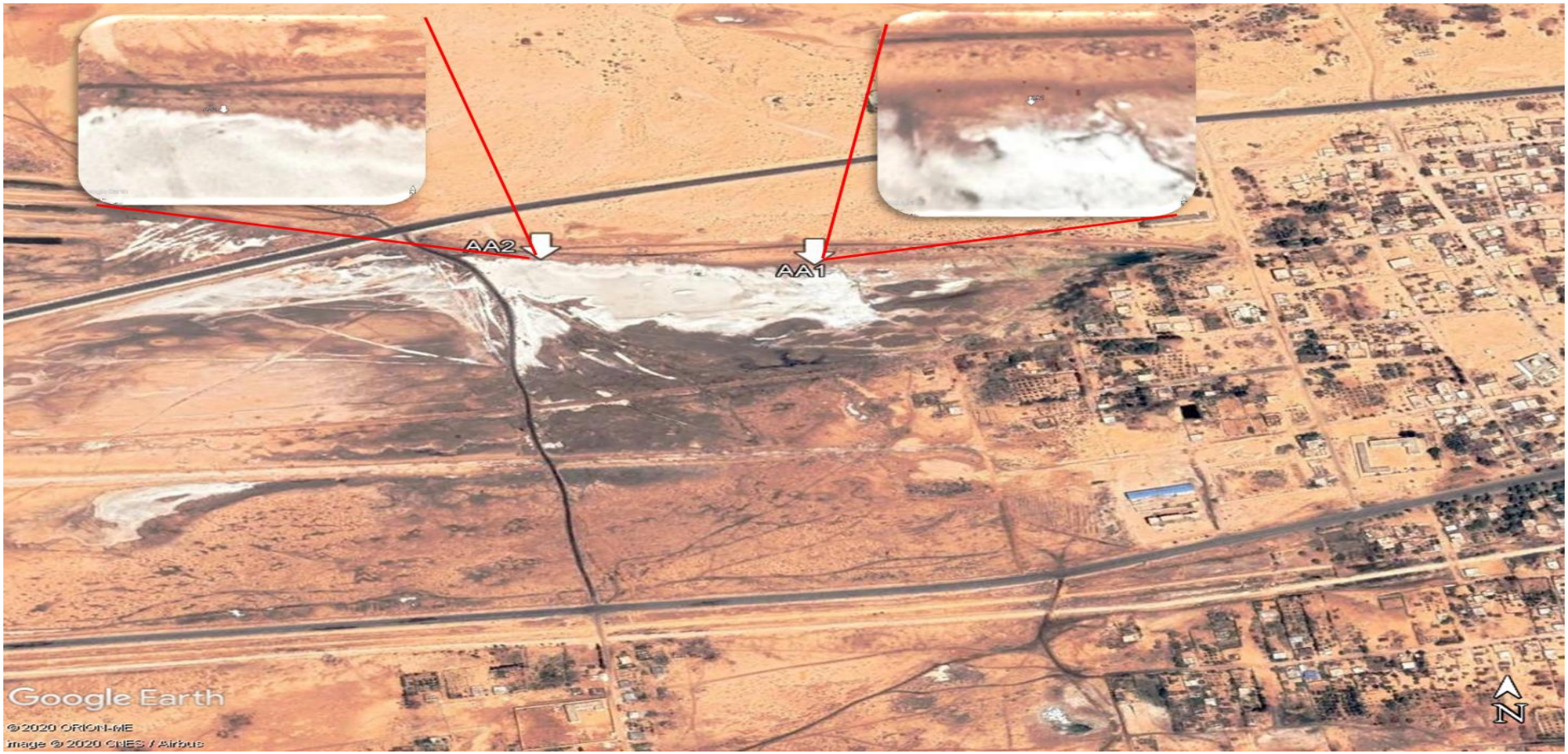


Figure 1-1 locations map for Ambient Air Quality and noise measurements

2. LEGISLATION AND REGULATORY FRAMEWORK

2.1 National and International Legislation

The results of ambient air quality measurements were compared to the national limits set in Annex 5 of the Executive Regulation (D1095/2015) and the guideline values of world health organization (WHO) for the ambient air quality.

Table 2-1 and Table 2-2 lists the corresponding applicable national and international ambient air quality permissible limits.

Table 2-1 Applicable national permissible limits for ambient air quality levels for rural area

Pollutant	**Average Period**	**Egyptian Standards ($\mu g.m^{-3}$)**	**Egyptian Standards (ppm)**
Sulphur dioxide (SO_2)	1 hour	350	0.1337
	24 hours	150	0.0573
	Annual	60	0.0229
Carbon monoxide	1 hour	30,000	26
	8 hours	10,000	9
Nitrogen dioxide (NO_2)	1 hour	350	0.2
	24 hours	150	0.08
	Annual	60	0.032
TOTAL suspended particulate T.S.P	24 hours	230	---------
	Annual	125	---------
Thoracic particles (PM_{10})	24 hours	150	---------
	Annual	100	---------
$PM_{2.5}$	24 hours	100	---------
	Annual	70	---------

Table 2-2 WHO Ambient Air Quality Guidelines2,3

Pollutant	Average Period	Guideline value (µg.m^{-3})
Sulphur dioxide (SO_2)	24 hours	125 (interim target 1) 50 (Interim target 2) 20 (guideline)
	10 minutes	500
Nitrogen dioxide (NO_2)	1 hour	200
	1 year	40
Thoracic particles (PM_{10})	24 hrs	150 (interim target 1) 100 (interim target 2) 75 (interim target 3) 50 (guideline)
	1 year	70 (interim target 1) 50 (interim target 2) 30 (interim target 3) 20 (guideline)
Ozone	8 hours daily maximum	160 (interim target 1) 100 (guideline)

[2] World Health Organization (WHO). Air Quality Guidelines Global Update, 2005. PM 24-hour value is the 99th percentile.
[3] Interim targets are provided in recognition of the need for a staged approach to achieving the recommended guidelines.

3. METHODOLOGY

3.1 Ambient air quality

Ambient Air Quality Monitoring equipment is an integrated system of which includes several analyzers with data recording devises. A typical system would include gas analyzers for ambient air analysis.

Ambient air pollutants

The most common gaseous air pollutants (also known as "criteria pollutants") are carbon monoxide, sulfur oxides, and nitrogen oxides. These pollutants can be harmful to health and the environment, and cause property damage. To acquire baseline information on background levels of Thoracic Particulates, the team conducted for one-hour active sampling using a dust sampler. The sampler measures the respirable fraction of airborne dust (of particle size 0.1 to 10 µm) with a measuring range of 0.001 to 400 mg/m3 and an accuracy of ± 5 % of the reading. The levels measured and recorded would serve as baseline values for reference during future monitoring activities.

Ambient air quality monitoring station specifications

General Features

- Standard methods of measurement which means:
- SO_2 analyzer: ISO 10498 equivalent to(U.S.A EPA Reference method – EQSA-0486-60) – UV Fluorescence
- NOx analyzer: ISO 7996 equivalent to(U.S.A EPA Reference method – RFNA-1289-74) – Chemiluminescence
- CO analyzer: ISO 4224 equivalent to U.S.A EPA Reference method – RFCA-0981-54) – IR GFC
- PM_{10} sampler: Plow volume sampler equivalent to(EPA method, Appendix J-Reference method FR)
- T.S.P low volume sampler equivalent to(EPA method, Appendix J-Reference method FR)

Ambient Particulate Matter PM_{10} sampler

- Approval and Certification: U.S.EPA (USA), UBA/ TUV (Germany), / Sira Certification Service
- Measuring Method: Sequential Particulate sampler
- Sampling on filter membranes, which can be used for further Chemical analyses as required by current regulations and standards.
- Active flow Control Flow range: 0-10 LPM
- Nominal flow: 5LPM Sampler

- Dimensions: 10” x 12” x 7” Sampler
- Weight: 9.8LBS (fully configured) Transport Case: 19.75” x 12” x 18”
- The analyzer should be equipped with batteries in order to avoid possible data losses due to power failures.
- Source: Beta Ray Source with appropriate activity
- Ranges: 0-500 µg/ m^3 (2.3 m^3/ h operating flow rate); 0-1,000 µg/ m^3 (1 m3/ h operating flow rate)
- Lower Detectable Limit: ≤ 1.5 µg/ m3 (24 hour cycle time, 2.3 m3/ h operating flow rate)
- Precision: ≤ 0.4 µg/ m^3 (24 hour cycle time, 2.3 m^3/ h operating flow rate)
- Correlation Coefficient R > 0.98

Sulphur Dioxide SO_2 Analyzer (Thermo Scientific SO_2 Analyzer model 43i-USA)

- Approval and Certification : U.S.EPA (USA), UBA/ TUV (Germany), / Sira Certification Service
- Measuring Method : UV Fluorescence Technology
- Ranges.: Auto ranging feature, Multiple Ranges to cover from 0 to 10 ppm (especially from 0 to 1 ppm)
- Zero Noise: ≤ 0.5 ppb
- Lower Detectable Limit: ≤ 1 ppb
- Zero drift (daily): ≤ 1 ppb
- Span drift (daily): ≤ 1% of full scale
- Response time: fast, ≤ 100 seconds
- ◆ Precision: ≤ 0.5% of reading
- Linearity: ≤ ± 1% of full scale
- Operating temperature: not exceed 40 °C

Nitrogen Monoxide, Nitrogen Dioxide and Nitrogen Oxides NO, NO_2 & NO_X Analyzer (Thermo Scientific NOx Analyzer - Model 42i- USA)

- Approval and Certification: U.S.EPA (USA), UBA/ TUV (Germany), / Sira Certification Service

- Measuring Method.: Chemiluminescence Technology
- Ranges.: Auto ranging feature, Multiple Ranges to cover from 0 to 20 ppm (especially from 0 to 1 ppm)
- Zero Noise: ≤ 0.2 ppb
- Lower Detectable Limit: ≤ 0.4 ppb
- Zero drift (daily): < 0.5 ppb
- Span drift (daily): < 0.5% of full scale
- Response time: fast, ≤ 100 seconds
- ◆ Precision: ≤ 0.5% of reading
- Linearity: ≤ ± 1% of full scale
- Operating temperature: not exceed 40 °C

Carbon Monoxide CO Analyzer (Thermo Scientific Carbon Monoxide CO Analyzer model 48i-USA)

- Approval and Certification: U.S.EPA (USA), UBA/ TUV (Germany), / Sira Certification Service
- Measuring Method: Non Destructive Infra-Red Gas Filter Correlation (IRGFC) Technology
- Ranges: Auto ranging feature, Multiple Ranges to cover from 0 to 200 ppm (especially from 0 to 50 ppm)
- Zero Noise: ≤ 0.02 ppm
- Lower Detectable Limit: ≤ 0.04 ppm
- Zero drift (daily): ≤ 0.1 ppm
- Span drift (daily): < 0.5% of reading
- Response time: fast, ≤ 100 seconds
- ◆ Precision: ≤ 0.5% of reading
- Linearity: ≤ ± 1% of full scale
- Operating temperature: not exceed 40 °C

3.2 Noise Measurement Methodology

The methodology adopted was to record ambient noise levels for one hour, as per the national and international standards, in the location at the proposed project site. The following devices had used

during the first round of noise level measurements:

- Two B & K 2238 Mediator, Integrating Sound Level Meters, Type I (precision grade), compliant with IEC 1672 Class 1 standard;
- B & K 4198 Outdoor Weatherproof Microphone Kit;
- GPS unit (Garmin MONTANA 650); and
- Digital Camera.

Noise monitoring measurements included recording the following parameters using a Type 1 precision grade hand-held sound-level meters:

- Equivalent continuous noise level (LAeq)
- 95th percentile noise level (LA95)
- 90th percentile noise level (LA90)
- 50th percentile noise level (LA50)
- 10th percentile noise level (LA10)
- Peak sound pressure level (LCpeak)

The following equation[4] is the main equation used to calculated day night equivalent sound pressure level:

$L_{den} = 10\log\frac{1}{n}\sum_{i=1}^{n}10^{0.1(L_i+D_i)}$ **Where** L_{den} = Day Night Equivalent , L_i = The hourly L_{eq} ,

D_i = the addition for the different periods of the day , n = number of measured hours .

The sound level meters have calibrated before sound measurements to ensure reliability and precision. GPS coordinates and meteorological conditions have recorded using hand-held kits at all locations prior to the start of noise measurements. It has anticipated that the location of concern would remain the same for the purpose of pre-construction, construction, performance guarantee tests and operation

[4]The equation used to obtain the average noise level of a designated time interval based on weighted readings according to "Long-term Leq errors expected and how long to measure (Uncertainity & Noise Monitoring)", Dietrich Kuehner, Forum Acusticum 2005 Budapest.

monitoring.

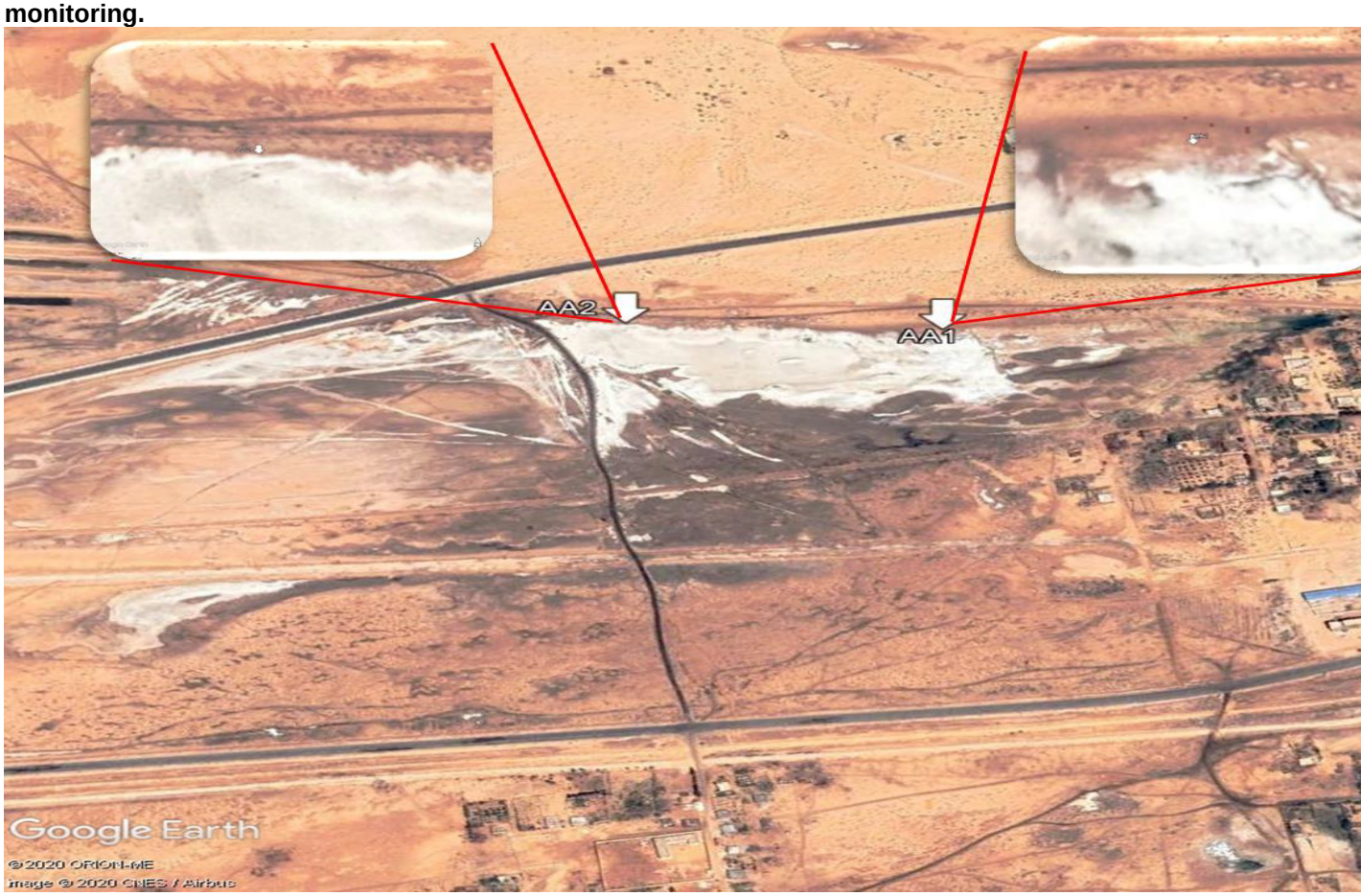


Figure 1-1 shows the location of the noise measurement; furthermore, Table 1-1 lists the GPS coordinates of measurement location, measurement dates, location description and a selection of photos at each location.

4. RESULTS

The following tables present the results for ambient air quality measurements conducted at the location. The objectives of the ambient air quality Monitoring activities conducted at the proposed site are:

- To verify compliance with authorized discharge limits and any other regulatory requirements concerning the impact on the public and the environment due to the normal operation of a practice or a source within a practice;
- to establish air quality baseline which will assist in the estimation of the site impact on the local physical, biological and social environment ;
- To check the conditions of operation and the adequacy of controls on discharges from the source and to provide a warning of unusual or unforeseen conditions and, where appropriate, to trigger a special environmental monitoring program.

The air qualities at the current site of the project site in the location are exhibiting acceptable levels of classic air pollutants in fact the levels are way below the national guidelines. Generation and dispersion of dust from increased vehicle traffic, especially during the daily activities, may reduce visibility, relative to baseline levels, and, together with combustion engine emissions, may affect ambient air quality. Concentration of dust particles, both total suspended particulate and respirable particulate matter and other pollutants from open burning, emissions from equipment and machinery used in transportation, the nearby plant operations and emissions from vehicles used to transport passengers also contribute to air pollution. These impacts may affect the human environment and, typically, arise during the ordinary daily activities and, to a much lesser extent, during the operation phase, requiring monitoring and assessment of the natural and man-made air pollutants.

One-hour average results for 2 hours continuous measurements have shown in Table 4-1 for all the measured parameters

Table 4-1 daily average results (µg/m^3) First Location AA1

Time	NO	NO_2	NOx	SO_2	CO (mg/m^3)	$PM_{2.5}$	PM_{10}
10:AM	11.8	11.5	22.3	10.6	2.3	9.6	78
11:00	10.8	12.3	19.1	11.2	2.7		
Limits	**-**	**300**	**150**	**300**	**30 (mg/m^3)**		**150**

Table 4-2 daily average results (µg/m^3) Second Location AA 2

Time	NO	NO2	NOx	SO2	CO (mg/m3)	$PM_{2.5}$	PM_{10}
10:AM	8.8	13.5	22.3	10.6	1.9	12.5	82
11:00	9.8	14.3	19.1	11.2	2.2		
Limits	-	300	150	300	30 (mg/m3)		**150**

4.1 Analysis of air quality Results

In general, there are two main factors affecting the ambient air concentration of a certain pollutant emitted from a certain source or sources in a selected area:

- The intensity of the emissions (e.g. concentration and flow rate) from the source or sources.
- The uncontrollable atmospheric dispersion conditions, which include but not limited to (wind speed, wind direction, temperature, humidity, rainfall, atmospheric turbulence, solar radiation intensity and atmospheric pressure).

All the recorded results showed compliance with the national and international guidelines for ambient air quality moreover, most of the data recorded were way below the guidelines, which indicates that the ambient air quality in this area are matching with guidelines of emissions released from proposed sources.

4.2 Site Specific Meteorological data

The meteorological conditions were also recorded in the same locations, weather station included wind direction, wind speed, relative humidity and temperature, Figure 4- 5 which represents recorded averages in each measured location during the sampling time

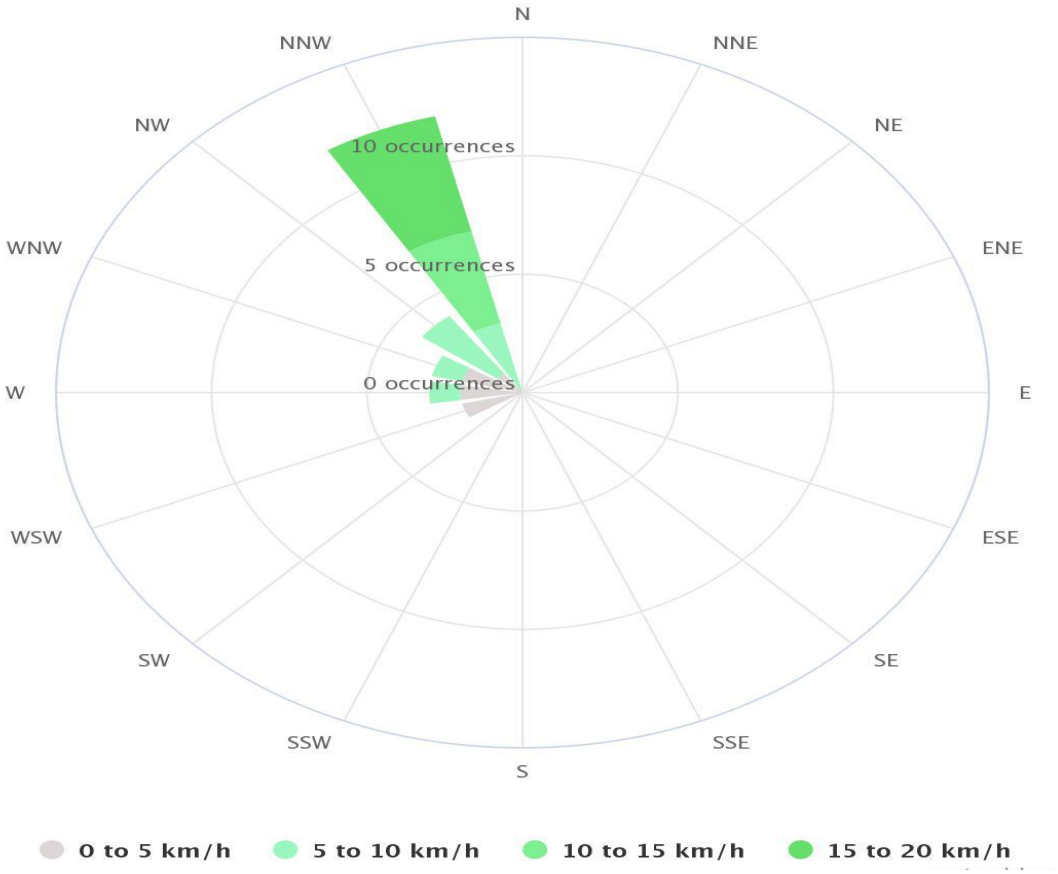


Figure 4-1 Daily wind rose graphical presentation

5. NOISE LEVELS RESULTS

Table 5-5-1 presents the results of one-hour average ambient noise measurements and their corresponding national and international permissible limits.

Table 5-5-1 Ambient Noise Levels Readings at AA 1 location One-hour average

Time	Sound Level Equivalent & Percentile Recordings in dBA for 8 Hours						Permissible Limits LAeq (dBA)	
	LAeq	LA10	LA50	LA90	LA95	LCpeak	National	International
10:00	**56.82**	51.52	41.05	32.93	43.27	119.97	60	70
11:00	**55.96**	48.06	37.62	25.4	29.83	125.52		

The results of ambient noise measurements had compared to the national permissible limits

Table 5-5-2 Ambient Noise Levels Readings at AA2 location One hour average

Time	Sound Level Equivalent & Percentile Recordings in dBA for 8 Hours						Permissible Limits LAeq (dBA)	
	LAeq	LA10	LA50	LA90	LA95	LCpeak	National	International
10:00	**57.62**	54.52	49.05	37.93	36.27	119.97	60	70
11:00	**56.96**	48.06	39.62	30.4	28.83	131.52		

6. CONCLUSION

Based on the environmental monitoring and measurements performed for the ambient air quality and Noise, the results showed compliance with all the national and international guidelines.

7. FUTURE RECOMMENDATION

It is recommended that monitoring should continue for all the regulated parameters, in order to verify/assure compliance.

8. REFERENCES

- EU directive 2008 50 EC -ANNEX I Data quality objectives for ambient air quality assessment
- D1357-95 (Reapproved2000) Standard Practice for Planning the Sampling of the Ambient Air
- Egyptian Law 4/1994 Amended by law 9/2009 and Decree 1741/2005, amended by decree 1095 /2011 Annex 6 (amendments to executive regulations of Law 4).

Climate-Change Resilience: climate change-related sectoral risks, GOE mitigation-adaptation strategies, and USAID/Egypt related activities

Climate change is one of many challenges Egypt must recognize and respond to in planning for the future. By increasing risks to human health, welfare, and ecosystems, climate impacts can threaten primary development goals such as reducing poverty, increasing access to education, improving child health, combating disease, or managing natural resources sustainably.[1] The following analysis provides an initial look at climate considerations in development decision-making, within the Egypt context. These considerations are aimed at promoting climate-resilient development by taking into account climate stressors and both climate variability and change, within USAID/Egypt's development goals.

USAID defines climate-resilience as the following: the capacity of a system to "anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration, or improvement of its essential basic structures and functions."[2] Applied to social systems, resilience is the capability to anticipate, prepare for, respond to, and recover from significant stressors with minimum damage to social well-being, the economy, and the environment. Essentially, the more resilient a system (e.g., ecosystem, village, country) is, the less vulnerable it is to climate change (and climate variability such as extreme events).

Climate Change in Egypt: By the year 2100, the mean global temperature is expected to rise by 3-3.5 degrees Celsius[3], and sea levels are projected to rise between 0.5 and 1 m. For Egypt, these climatic and environmental changes will be felt in five primary areas: inundation of the Nile Delta by sea level rise (SLR), changes in water resources, changes in agro-climatic conditions, negative impact on public health, and threats to touristic sites.

Sea Level Rise: Estimates of inundated land due to SLR in the Nile Delta, by the year 2100, range between 4,006 and 8,769 km^2 (22 to 49%, respectively)[4]. The uses of this inundated land include urban areas, cultivated land, undeveloped land and wetlands. Compounding the influence of SLR, is the phenomenon of land subsidence in much of the urbanized coastal areas. This has occurred because of geologic destabilization caused by salt-water intrusion. Overexploitation of groundwater resources in urban areas has lowered the freshwater water table, leading to salt-water intrusion. Land subsidence has already resulted in the formation of cavities and spontaneous sinkholes, impacting the structural integrity of buildings in Alexandria. Land subsidence is exacerbating the influence of SLR on coastal areas, speeding up the impact of climate change in that region. Cultivated lands make up approximately 60% of the land that will be inundated by SLR. The Nile Delta contains the majority of the prime

[1] Taken from USAID's "Climate Resilient Development," March 2014. http://pdf.usaid.gov/pdf_docs/PBAAA245.pdf
[2] IPCC. 2012. Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. IPCC. Cambridge University Press, Cambridge, UK and New York. p. 5.
[3] Met-Office of Hadley Centre (2011) in the Jan. 2013 CC adaptation report
[4] Hassaan, M.A. and M.A. Abdrabo. 2013. Vulnerability of the Nile Delta coastal areas to inundation by sea level rise. Environ. Monit. Assess. 185:6607-6616.

agriculture land in Egypt, and contributes 30-40% of Egypt's agriculture production. A recent interdisciplinary assessment on the impact of SLR on the Nile Delta reported that with a 0.5m SLR, approximately 13% of Egypt's total agriculture land will become inundated[5]. This same report estimates that approximately 3.8 million people will be directly impacted by a 0.5m SLR. The residents of impacted areas, mostly employed in the agriculture sector, will have to relocate. This will put strain on the public infrastructure of migration points (often urban centers).

The Government of Egypt has developed a strategy of adaptation to climate change (December 2011[6]), including the impact of SLR to the Nile Delta. They propose four interventions to meet this challenge: 1) develop and enforce rules about building and the development of lowlands; 2) structural and architectural interventions; 3) rehabilitation of roads and protective structures; and, 4) reinforce natural protection.

USAID/Egypt has spent considerable resources in the past on water and sanitation infrastructure in the Nile Delta region, particularly in Alexandria and El Mansura. The water treatment centers, which purify Nile River water, reduce the need to pump groundwater for domestic consumption. As previously discussed, groundwater extraction is a major cause of land subsidence and increases the vulnerability of areas to the impacts of SLR. Other USAID programing, such as agriculture, have refocused their resources to regions less susceptible to the impacts of climate change (Upper Egypt). In order to improve the climate change resilience of the population in the Nile Delta region, future programming should include job training for people that will lose their land and source of livelihood. This should be in partnership with GOE and private sector efforts to develop industrial zones in the 'new-land' areas.

Water Resources: The Nile River supplies Egypt with approximately 95% of its total water needs. In 1959, Egypt signed the Nile Water Treaty allocating it 55.5 billion cubic meters of water per year. This represented an abundant supply of water for the population of Egypt at that time (25 million in 1959), however the present day population is 87 million and water share per capita has reached the 'water scarce' classification. Additional sources of water can be classified into two categories: conventional and unconventional[7]. Conventional sources of water and their annual contribution (in billions of m^3) to supplies include deep groundwater (2.0), rainfall-flash floods (1.3) and desalination (0.2). Unconventional sources of water include shallow groundwater (6.2) and the re-use of agriculture drainage water (16.0). The total water supply, including these additional sources, is 81.2 billion m^3. However, this accounting method double counts some water as it is first used for agriculture and then reused when pumped out of shallow wells or recirculated out of drainage canals. Approximately 70% of all freshwater is consumed by the agriculture sector (discussed in more detail below), with only small

[5] Susnik, J., Vamvakeridou-Lyroudia, L.S., Baumert, N., Kloos, J., Renaud, F.G., Jeunesse, I.L., Mabrouk, B., Savic, D.A., Kapelan, Z., Ludwig, R., Fischer, G., Roson, R. and Zografos, C. 2015. Interdisciplinary assessment of sea-level rise and climate change impacts on the lower Nile delta, Egypt. Science of the Total Environment. 503-504: pg. 279-288.

[6] Egypt's National Strategy for Adaptation to Climate Change And Disaster Risk Reduction. December 2011. http://cairoclimatetalks.net/sites/default/files/Adaptation%20Strategy%20-%20Final%20-%20E.pdf

[7] Climate change adaptation strategy for the Ministry of Water Resources and Irrigation, Egypt. 2013. Pg. 16.

portions going to drinking water and industry, 2 and 3% respectively. The remainder of the balance is lost in drainage to the sea and evaporation.

Groundwater is increasingly becoming an important source of water as land is being developed away from the Nile. The primary aquifers in Egypt are the Nile Valley aquifer, the Nile Delta aquifer, the Nubian sandstone (NSA) aquifer and the Post Nubian carbonate aquifer. The Nile Valley and Nile Delta aquifers are alluvial and are recharged by return flows from agriculture and sporadic rainfall. These are shallow aquifers ranging from 100m to 1000m in depth. Abiye and Mmayi (2014) conducted a rapid assessment of these aquifers using published data. The Nile Valley aquifer has reached the limits of its exploitation where abstraction rates are equal to the recharge rate (~1.3×10^9 m^3/yr). The Nile Delta aquifer is still underutilized at this point, however with SLR and saltwater intrusion increasing in the future, it is uncertain how viable this aquifer will be in future years. The Post Nubian carbonate aquifer lies above the NSA aquifer (200-900m), and is recharged via upward leakage from the NSA and downward percolation from the Nile River. Its recharge and abstraction rates are unknown, but it represents a significant amount of water storage (25×10^{12} m^3/yr). The NSA is a vast but nonrenewable source of water. The ^{14}C signature for groundwater from the NSA places the age of the water at 20,000 to 45,000 years. While its storage capacity is estimated to be 285×10^{12} m^3/yr, development plans based on utilization of this aquifer would not be sustainable as there is no aquifer recharge.

The Nile River will continue to be the dominate source of water in Egypt for the foreseeable future. The treaty that once governed access to the Nile's water, is now being rethought as upstream countries have begun to develop irrigation and hydroelectricity schemes. Climate change scenarios in the Nile Basin are not unified, where some predict more flow and others less. Under a scenario of increased flow, with upper Nile projects, total water allotment to Egypt in 2050 would be 57.48 billion m^3/yr[8]. Despite this increase in flow, the per capita water share by 2050 will be 399 m^3/cap/yr (below the absolute water scarcity threshold) due to rapid population growth. Under a dry scenario, the situation is even worse. Egypt's portion of the Nile flow will drop to 40.38 billion m^3/yr, and the per capita water share will be 290 m^3/cap/yr. There will be a water crisis in Egypt by 2050 regardless of the impact of climate change, primarily due to population growth.

The GOE has developed an adaptation strategy to reduce the impact of climate change on water resources. 1) The GOE will improve the flexibility of the flood control system along the Nile River. This will create resilience in the face of water resource uncertainty. 2) The GOE will adapt their systems to increased/decreased water flow in the Nile. In the case of less flow, they will need to prioritize uses and begin to price the use of water to create incentives for conservation. 3) The GOE will maximize the use of rainwater and flash flood waters (in applicable areas). This includes building water retention/storage structures which can be accessed during dry periods.

Over the last several decades, USAID/Egypt has partnered with the GOE to develop Egypt's potable water management infrastructure, and the human capacity to facilitate its sustained use. This includes water treatment plants located throughout Egypt, to help bring potable water to the Egyptian people.

[8] Climate change adaptation strategy for the Ministry of Water Resources and Irrigation, Egypt. 2013. Pg. 63.

Large investments in sanitation facilities have also been made, so that water resources can be reused in certain types of agriculture. A majority of Egypt's water resources is used by agriculture. USAID/Egypt agriculture interventions have worked to improve irrigation infrastructure and reduce seepage losses. Technical assistance has also been given to farmers to help them improve their irrigation efficiency. This has resulted in a reduction of water loss and improved supply for downstream users. These interventions in the drinking/sewage/irrigation sectors will help Egypt to respond to changes in water resource availability, which are expected to result from climate change.

Agriculture: Egypt has enjoyed a favorable climate for agriculture development along the Nile Valley and Delta regions for millennia. Although arable land in Egypt only makes up 5.3% of total landholdings, its production has been maximized. The cropping area in 2007 reached 15.4 million feddans (1 feddan ~ 1 acre). Wheat, maize, rice, cotton and sugar beet are the dominate crops, where wheat occupies nearly 18% of all cropped area. Vegetable and fruit crops make up 13 and 8.5% of the cropped area, respectively. Crops are almost exclusively irrigated as rainfall is extremely low for the majority of the country. Animal production also contributes significantly to the agriculture gross domestic product (42.7% in 2007). Milk and meat production accounted for 24.4% of this, with poultry and fish making up the remainder. Animal production is dominated by smallholder farmers, where 89% of the cattle population and 75% of the buffalo population are in agriculture holdings of less than 5 feddans.

The projected changes in agro-ecological conditions along the Nile River Valley and Delta, will significantly reduce crop and livestock productivity as well as shift agriculture zones. Wheat yields are expected to decrease by 18%, with similar decreases for maize and rice. The only crop expected to become more productive is cotton, with a 10% increase by 2030. Animal production is also expected to be negatively impacted, as disease vectors are favored by increased temperatures. The GOE plans to expand agriculture activities to marginal lands (reclaimed desert) will be made more difficult as desertification rates are expected to increase. As previously discussed, agriculture consumes 70% of the water resources in Egypt. A rise in temperature would increase this amount as evapotranspiration rates also increase putting a strain on Egypt's already scares water resources. SLR is estimated to result in the loss of approximately 13% of Egypt's agriculture lands in the Delta. The agriculture sector makes up 14% of the GDP, and is expected to remain a significant contributor to economic growth into the future. In terms of sustained food security in Egypt, a strong agriculture sector is essential. A comprehensive effort will need to be undertaken to efficiently utilize water and land resources so that the production of water conservative crops is maximized, striking a balance between capitalizing on the lucrative export market and the need to ensure a stable domestic food supply.

The GOE's strategy for the agriculture sector to adapt to climate change is based on nine interventions. 1) A new institutional system for dealing with crisis and disaster management will be established, to assess and focus efforts to deal with climate change. The second and third interventions are aimed at finding crop species which are less sensitive to temperature change. 2) This includes efforts to preserve Egypt's biological diversity, as a means to protect potential resources for climate resilient (adapted) species. 3) Along these same lines, the current plant production and breeding program will be refocused so as to develop adapted species. The fourth and fifth interventions focus on soil and water adaptation interventions. 4) One of the main impacts of SLR will be an increase in soil salinity in the

Delta region. The GOE will develop and promote better soil management to mitigate salinity is salt effected lands. 5) Similarly, water management practices that increase irrigation efficiency will be promoted. This includes amendments to the near surface soil to improve the soils capacity to hold water. In new lands where the soils are sandy, this is of particular concern as the water holding capacity of these soils is low and requires frequent irrigation. Animal production adaptations are addressed in the sixth and seventh interventions. 6) New livestock diseases are expected to appear with climate change, and the GOE will develop livestock disease control measures to recognize and counter the impacts of these diseases. 7) Egypt's fish biodiversity is quite high, and efforts will be made to preserve this genetic diversity. The final interventions for climate change adaptation in the agriculture sector concern social safety nets for farmers and farming communities. 8) The GOE will improve the agriculture economic system, in terms of crop insurance, promoting the diversity of cropping patterns, and provide price forecasting. 9) In order to take full advantage of the previous intervention, there will be significant efforts to build the capacity of rural communities. In particular, this will be accomplished by upgrading farming practices, improving resource management and encouraging farmers to approach farming as a business.

In the 1980s, USAID/Egypt's agriculture programs focused on increasing farmer productivity and instituting policy reforms, particularly those related to decreasing government controls on farmers. Decentralized farm production allows farmers to respond to market demand, and improves their ability to rapidly adopt new practices. These early interventions helped set the foundation necessary for the agriculture sector to adapt to climate change in the future. In a natural expansion of previous programs, USAID/Egypt agriculture activities shifted their focus in the 1990s to include demand-driven horticulture production, innovative post-harvest and marketing technologies, and agricultural biotechnology. Horticulture crops are more water efficient than staple crops and often have a greater margin of return for farmers. Post-harvest interventions improve the economic resilience of farmers by prolonging the shelf-life of products. Technical assistance to develop biotechnology research in Egypt has helped researchers to develop climate adapted crop varieties. In an effort to capitalize on Egypt's comparative advantage in agriculture, reduce poverty, and lower high rates of unemployment, programs in the 2000s addressed three key issues in Egypt: high unemployment, low rural income, and underdeveloped agricultural export potential. USAID supported farmer associations in Upper Egypt and linked them to the European markets and large domestic processors like Heinz. Diversifying income sources for farmers will further help improve their economic resilience in the face of climate change. Current interventions are focused in Upper Egypt, where the greatest potential for development still exists. Horticulture value chains are being developed, where smallholder farmers have formed associations to pool production in order to gain access to more lucrative domestic and export markets. The cold chain support and post-harvest infrastructure are being developed in cooperation with the private sector, and will reduce the amount of post-harvest losses (which are expected to increase with elevated temperature). Improving farmer's capacity to respond to changes in climate in terms of farming practices as well as market demand are key to helping Egyptian farmers prepare for coping with the uncertainty of climate change.

Health: Future climate change in Egypt will affect basic health requirements, clean air, drinking water, adequate food and safe shelter. SLR in the Delta region will displace people, destroy health

infrastructure in some locations, and reduce the availability of both drinking water and food supplies. It is estimated that 4-6 million people would be displaced by SLR and would be forced to migrate. This would put strain on the water and food resources in resettlement areas, and negatively impact public health. When properly treated water becomes scarce (and sanitation systems fail), people begin to utilize contaminated water as a means of survival. This would result in the spread of diarrheal and other viral, bacterial, and parasitic diseases transmitted by contaminated water (such as cholera and typhoid). SLR will also result in increased waterlogging of soils, which will create more habitat for insects and other disease vectors (particularly malaria). Water shortages will not only be felt in the Delta or resettlement areas, but over Egypt as a whole as previously discussed in the water resources section. Although this is primarily the result of population growth, climate change can be expected to amplify the water scarcity problem. The loss of agriculture land and fisheries due to SLR will cause food shortages and higher food prices, leading to increased malnutrition. Along the same lines, projected reduction in crop productivity is expected to reduce the production of basic nutrients by 30% (see reference 6, pg. 67). Along with water and food, changes in air temperature and quality are expected to also negatively impact human health. The intensity and frequency of heat waves are expected to increase, which contribute to increased illness and even death. The young and the elderly are particularly vulnerable to cardiovascular and respiratory diseases associated with hot weather and air pollution. Cumulatively, the health burden of sicknesses related to the degradation of water, food, and air resources via climate change will strain public health system.

The GOE's strategy to adapt to climate change in the health sector relies on five interventions. 1) The efficiency of the health care system to deal with climate change will be improved by strengthening the countries surveillance system for infectious diseases (particularly malaria), coordination with civil society organizations working in the health sector, and build the capacity of the emergency services. 2) An early warning system for disasters will help to prevent injuries, and thus reduce the cost to the public of such events. In order to utilize such a system, 3) public awareness about the risks of climate change to human health will be improved. 4) The risks to human health due to climate change are still being understood and will require continuing research to establish trends for early action. 5) At a higher level, efforts will be made to improve the social and economic conditions so that the population is better able to buffer changes. As economic conditions improve, it can be expected that the population growth rate will decrease resulting in less competition for resources.

USAID/Egypt works to improve Egypt's public health system and raise community awareness of health issues. Previous programming (up through 2008) promoted family planning, and in cooperation with the GOE was able to help bring about a significant decrease in total fertility rate from 5.3 to 3.0 (1980 to 2008, respectively). In the long-term, reducing population growth will be key to mitigating the impact of climate change on human health. The total fertility rate has risen back to 3.5, and the population growth rate does not seem like it will reach a replacement rate in the near future. Currently, USAID is supporting the GOE's efforts to combat infectious diseases (polio and hepatitis), as well as supporting community health workers in rural areas. These health care workers will be important to future GOE efforts to develop an early warning system, increase public awareness of climate change, promote safe behaviors with regards to water, food and air quality issues, and promote family planning.

Tourism: The tourism sector is interrelated to the other sectors (water, agriculture and health) and will be directly impacted by anything that influences them. For example, a reduction in water resources will require new tourism projects to rely on expensive desalinization units. Much of Egypt's tourism sector is located along the coastal zones, where tourists enjoy beaches and coral reefs. The projected rise in global temperature will increase the frequency of heat waves along these beaches making them less attractive for tourists. Coral reefs are also quite sensitive to changes in sea surface temperature. When temperatures rise, the algae that lives within the coral and gives it its beautiful colors, is lost and the coral takes on a bleached appearance. Approximately 15% of global coral reefs have been lost due to increased ocean surface temperature. SLR in the Delta as well as rising ground water levels (not related to climate change) in Upper Egypt are causing damage to touristic sites. Saline ground water reacts with the mineralogy of historic monuments (calcium carbonate) destabilizing the foundations of these structures. SLR along the coasts will result in the loss of most of the sandy beaches, primarily along the Mediterranean coast line which is a popular domestic tourist location. If the flow of the Nile decreases in the coming years as a result of climate change, the movement of floating hotels will be restricted. This will particularly impact the area between Luxor and Aswan where Nile Cruises are most popular. Although there has been a recent slump in tourism, this sector is a vital part of the Egyptian economy and is expected to remain as such into the future.

The GOE has identified eight interventions to address climate change in the tourism sector. 1) Marine and wildlife protectorates will be protected as feasible. 2) An integrated environmental management system for touristic sites will be implemented to bring greater unification in approach to dealing with climate change. 3) A national system will be developed for assessing the degree of fragility and vulnerability posed to touristic sites and those of archeological value. 4) In order to reduce the need for future interventions, tourism growth will be directed away from environmentally sensitive or vulnerable areas. 5) Once expected impacts of climate change are identified at touristic sites, the GOE will develop a monitoring system to track the progress. 6) Complementing the previous interventions, an analysis will be performed on the effectiveness of the enforcement of environmental protection laws. 7) The GOE will work with civil society organizations to participate in applying strategic operational policies. 8) As a final intervention, the GOE will develop direct positive defensive measures to counter the impacts of climate change. These will include engineering solutions to SLR, such as ocean walls, levees and pumping stations.

USAID/Egypt has worked to promote green tourism, marine conservation and the preservation of archeological sites. Green tourism activities were aimed at providing technical assistance to developers along the coastal zone, so that their designs would be water and energy efficient. This reduced the carbon footprint of these developments by reducing greenhouse gas emissions, and the conservation of water resources. USAID/Egypt works with local non-governmental organizations to preserve marine habitat and promote awareness about conservation among coastal communities. From Upper Egypt to the Delta, USAID/Egypt has installed groundwater lowering systems at archeological sites to preserve their structural integrity.

Summary: The five interrelated sectors discussed above will be severely impacted by climate change. Water and food resource limitations caused by SLR and temperature rise, will be compounded by

population growth. The basic requirements for human health will be stretched, and traditional sources of national income (agriculture and tourism sectors) are expected to contract rather than grow, further reducing the population's climate-resiliency. The GOE has prioritized interventions within their strategy for adaptation to climate change. Many of USAID/Egypt's previous and current activities are in line with this strategy. In compliance with the Executive Order on Climate-Resilient International Development, future planning efforts should look to partner even more closely with the GOE and other donors to implement these ambitions interventions.

Exposure Summary for Egypt

		Description of Climate Conditions	
		Current (based on historical climate conditions and recent trends, generally over the past few decades)	**Future 2050 (generally 2040 2059)**
Temperature	***Country level***	Annual mean temperatures increase from about 20°C on the Mediterranean coastline to around 24°C on the Red Sea coastline, 25°C at Cairo and 26°C further south at Aswan with a seasonal variation of about 7°C [UKMO]. Typical daytime maxima in midsummer range from 30°C at Alexandria southward to 41°C at Aswan; while the corresponding north-south range in midwinter daytime maxima is 18°–23°C. There have been widespread warming trends over Egypt since 1960 with greater warming in summer (0.31°C per decade) than during winter (0.07°C per decade); statistical confidence is higher for the summer warming trend. Between 1960 and 2003, there has been an increase in the frequency of warm nights and a decrease in the frequency of cool nights, and a general increase in average summer temperatures. Nighttime temperatures (daily minima) show a widespread positive shift in the distribution with fewer cool nights and more warm nights. Confidence is high throughout.	At midcentury, the median ensemble for RCP4.5 and RCP8.5's project mean annual temperature increases of 1.64°C and 2.33°C, respectively [CCKP]. Increases are highest in summer months of July-September (JAS). Increases in the number of hot days (especially in JAS), and decrease in the number of cool days are projected for the median ensemble by midcentury for the A2 and B1 scenarios. Over North Africa under the SRES A1B scenario, both annual minimum and maximum temperatures are likely to increase in the future, with greater increase in minimum temperature [IPCC Ch22].
Precipitation and Flooding	***Country level***	Annual average rainfall from 1961 to 1990 was 41.8 mm. About half of the yearly precipitation falls from December through March [CCKP]. Precipitation is generally very low throughout the country although along the Mediterranean coastline it averages more than 200 mm/yr [UNDP]. Precipitation rates drop quickly as one moves away from the coast and most of Egypt receives only about 2 mm of precipitation per year. Most of Egypt is a desert and is classified as arid (except for the Mediterranean coast, which is semi-arid). Given lack of precipitation data, there is low statistical confidence regarding historical trends [IPCC Ch 22]. There is a small region of drying in the northeast, where confidence in the signal is higher. There is evidence that the severity and frequency of flash flooding across Egypt has increased in recent years. Over the last few decades the northern regions of North Africa have experienced a strong decrease in the amount of precipitation received in winter and early spring.	A reduction in rainfall over northern Africa is very likely by the end of the 21st century [IPCC Ch 22]. The annual and seasonal drying/warming signal over the northern African region (including Egypt) is a consistent feature in the global and the regional climate change projections for the 21st century under the A1B and A2 scenarios. Rainfall projections are highly uncertain, but indicate slight reductions in rainfall in Egypt for most months by midcentury for the median ensemble RCP4.5 and RCP8.5 scenarios [CCKP]. It seems likely that the Mediterranean region will continue to get drier [UNDP]. Whether East Africa will get wetter or drier is less clear. The IPCC AR4 found consistency across GCMs that wet extremes could increase. There is uncertainty regarding the magnitude to which flood season discharge into the Nile River could be affected by climate change and GCMs are not consistent in simulating the same signs of change [UKMO].
Drought	***Country level***	Rainfall variability within Egypt is almost inconsequential, given that the country receives very little rainfall, as well as the fact that its agriculture is irrigated and not rain-fed [UNEP]. Variability in Nile flows are moderated by the High Aswan Dam. The dam has one year's worth of storage capacity, to help in handling periodic droughts, although Egypt remains vulnerable to multiyear droughts.	It seems likely that the Mediterranean region will continue to get drier [UNDP]. Whether East Africa will get wetter or drier is less clear. There is considerable uncertainty with regard to the projections of rainfall—both over Egypt as well as over the principal headwaters of the Nile [UNEP, OECD]. There is agreement across climate models that temperatures are projected to increase significantly under climate change, increasing the possibility of enhanced water losses from evapotranspiration—particularly given the arid climates of Egypt and Sudan— which might imply reduction in streamflows.
Sea Level Rise and Storm Surge	***Country level***	Sea levels have risen across the Mediterranean by an average of more than 3.1 mm each year since 1992, although records from further back indicate considerable local variability [Verner, et al.]. One array of tide gauges indicates that since 1990, Mediterranean sea levels have risen at a rate 5–10% faster than the 20th- century mean rate. Measurements on the Egyptian coast indicate that sea level is continuously rising at a rate of 1.8 and 4.9 mm/year with an average of 3 mm/year [Frihy and El-Sayed]. The relative sea level shows an upward increasing trend as a result of land subsidence and eustatic sea level. In recent years (December 2003, December 2010, and January 2011), major storms have struck the Mediterranean coastline of Egypt and have produced—during a short period—a surge of up to about one meter above the mean sea level.	Sea levels are projected to rise between 3 and 61 cm this century, depending upon local heat and salinity levels of the Mediterranean [WB]. Sea level rise projections in Egypt's delta are exacerbated by considerable land subsidence (5.0 cm/year), and a tidal range of about 20 cm [El-Nahry and Doluschitz]. One study used low (0.11m), medium (0.20m), and high (0.40m) scenarios for midcentury sea level rise in the delta region [El-Nahry and Doluschitz]. Particular risk areas in the Alexandria region are Mandara and El Tarh (east of the city), and risk areas in the Nile Delta region are the Manzala Lagoon barrier, east and west of the Rosetta City, Gamil, and the Tineh plain [Frihy and El-Sayed].
Winds and Other Storms	***Country level***	Egypt is not impacted by tropical cyclones [UKMO]. Climate hazards include dust storms in spring and early summer, which are a dry and dust-laden "Khamsin" wind that, from time to time, carries very hot air northward into northern Egypt ahead of weak cyclonic disturbances in the Mediterranean. Increased severity and frequency of sand storms and haze have been documented.	There are difficulties in analyzing changes in storminess, given the lack of robust historical analysis of local or global land surface winds or storminess currently available [UKMO].

Climate information source(s)

CCKP World Bank Climate Change Knowledge Portal

CW Climate Wizard

El-Nahry and Doluschitz El-Nahry, A. H. and R. Doluschitz, 2010. Climate change and its impacts on the coastal zone of the Nile Delta, Egypt. *Environ Earth Sci* (2010)

Frihy and El-Sayed Frihy, Omran E. and Mahmoud Kh. El-Sayed, 2013. Vulnerability risk assessment and adaptation to climate change induced sea level rise along the Mediterranean coast of Egypt. *Mitig Adapt Strateg Glob Change* (2013) 18 1215–1237

IPCC IPCC WG II, 2014. Climate Change 2014 Impacts, Adaptation, and Vulnerability. Chapter 22 (Africa)

OECD Organisation for Economic Co-operation and Development (OECD), 2004. Development and Climate Change in Egypt Focus on Coastal Resources and the Nile.

UKMO UK Met Office, 2013. Climate Observations, projections and impacts Egypt.

UNDP UNDP, 2013. Potential Impacts of Climate Change on the Egyptian Economy

Verner, et al. Verner, Dorte; Wilby, Robert; Breisinger, Clemens; Al-Riffai, Perrihan; Robertson, Richard; Wiebelt, Manfred; Kronik, Jakob; Clement, Viviane; Levine, Tamara; Esen, Ferhat Roos, Philippe, 2013. *Tunisia in a Changing Climate. Assessment and Actions for Increased Resilience and Development.* The World Bank, Washington, DC.

Updated 7/16/2015